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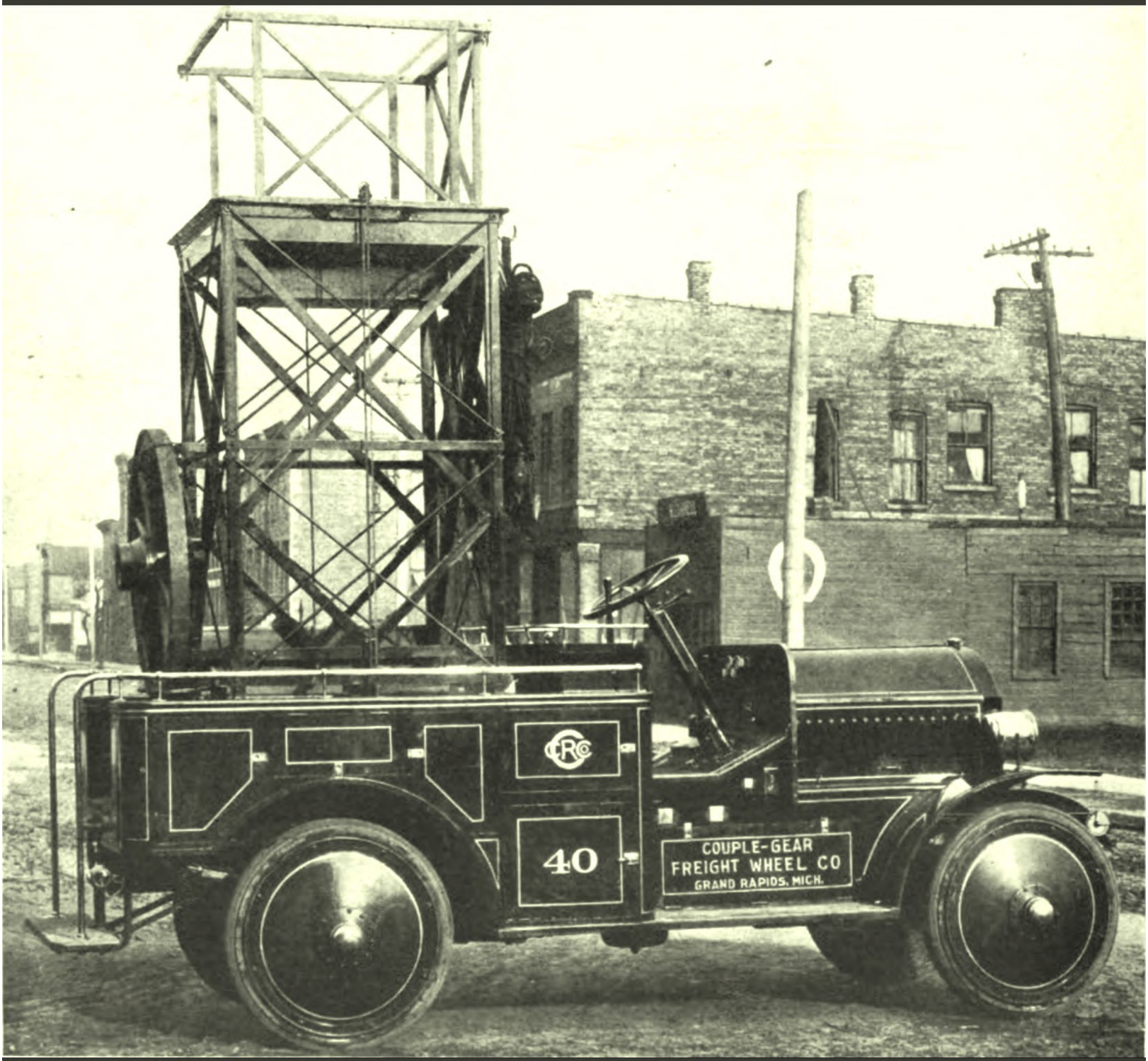

Power wagon

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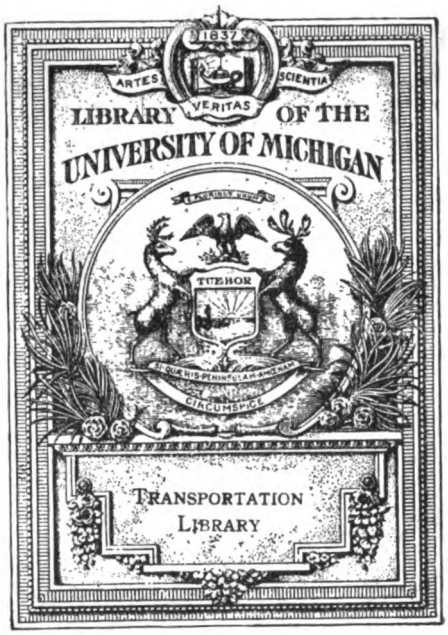

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No. 50. CHICAGO, ILL., JANUARY, 1909. Subscription, $2 per year. Single Copies, 20 Cents.

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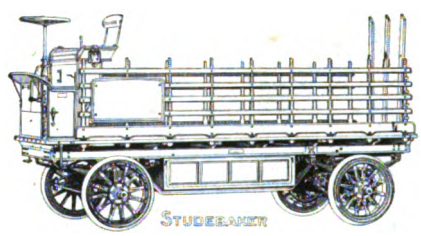

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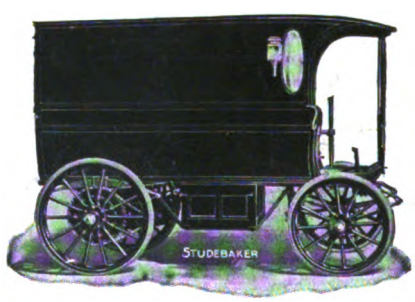

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At the Paris Salon, 1908, there were a greater number of chain driven cars than ever before. M. Georges Dupuy, the eminent French authority, comments as follows:—

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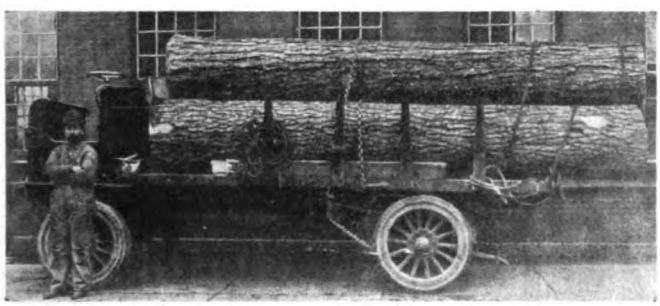

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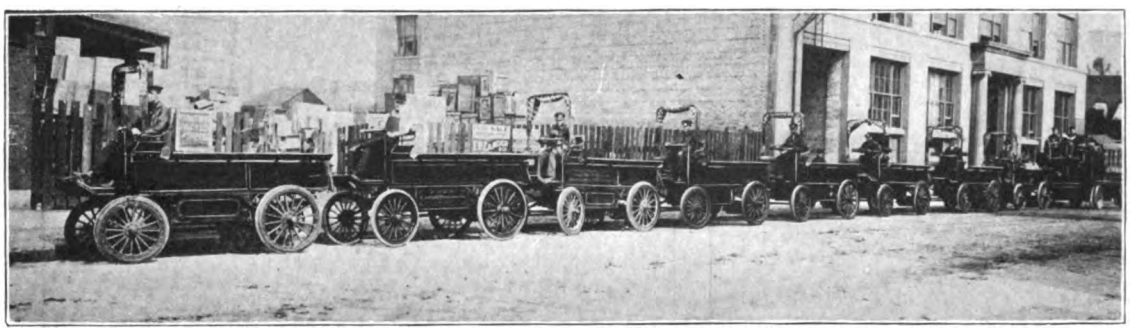

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We will be glad to co-operate with manufacturers and owners of Commercial Electric Vehicles in improving and perfecting this type of truck which is daily growing in popular favor.

A number of Chicago's largest commercial houses are utilizing electric trucks with notable success; more would doubtless use them if they were familiar with the superior facilities provided for their use.

We Maintain Charging Plugs at nearly all of our stations and sub-stations for the accommodation of those operating electric vehicles of any kind.

We would be glad to advise any one in Chicago contemplating the purchase of an electric vehicle as to where they may make arrangements for charging and up-keep.

We Install Charging Outfts for Private Use anywhere in Chicago and can refer to a number of installations. We solicit correspondence from manufacturers of traffic vehicles; also from those intending to purchase.

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See Our Exhibit at the Fourth Annual Electrical Show, Coliseum, Chicago, January 16-30, 1909.

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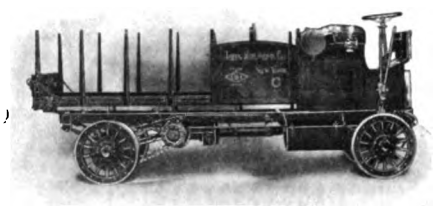

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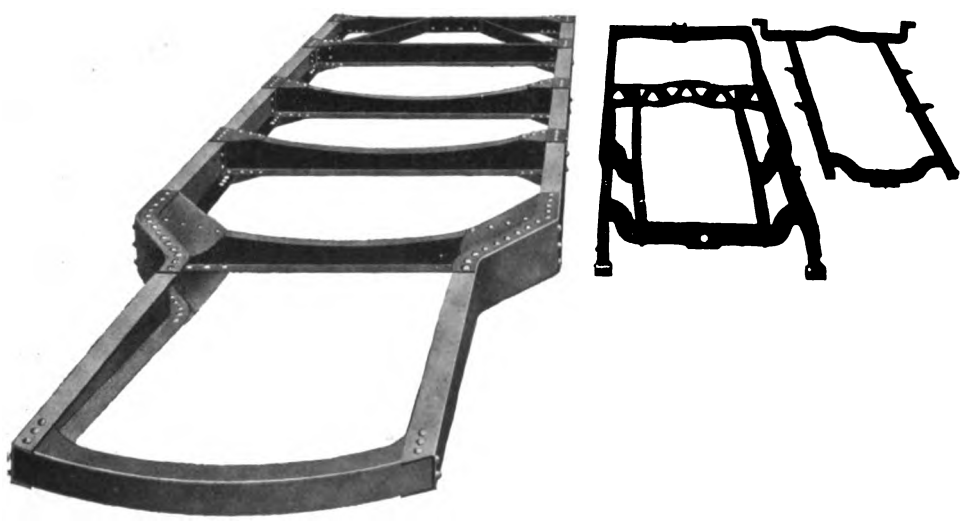

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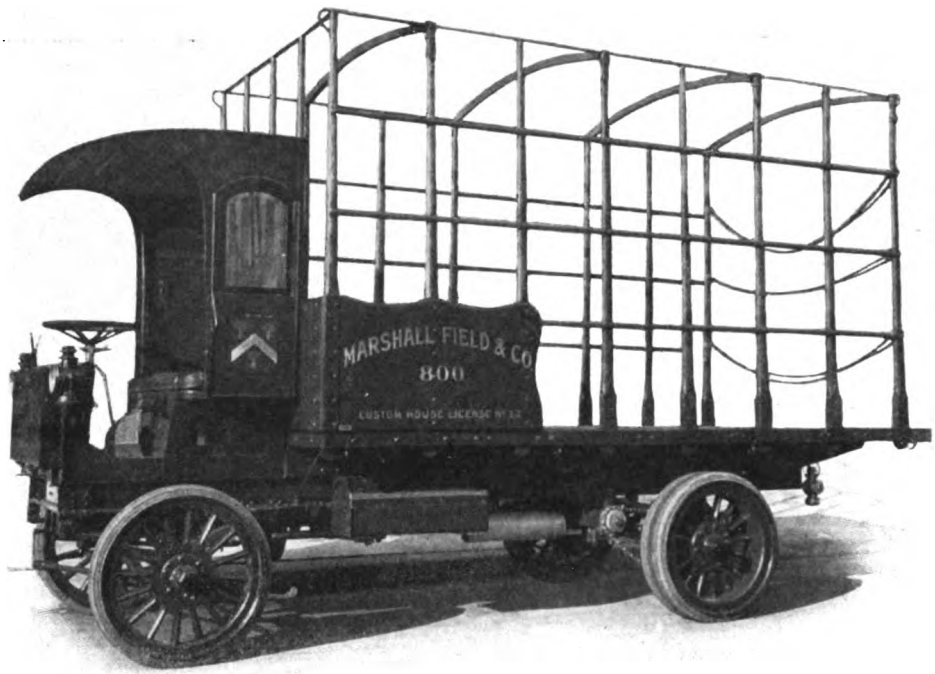
Two "Frayer Miller" Trucks, Like The One Shown Below, Were Recently Bought by Marshall Field & Co., of Chicago.



Three-Ton "Frayer Miller" Truck, employed in the service of Marshall Field & Co., Chicago.

At one time or another nearly every motor wagon maker in the country has sought to sell machines to this well known dry goods house. We secured the order after the whole field of manufacture had been passed in review.

This transaction indicates the confidence with which large concerns can accept the engineering of the "Frayer Miller" product. It is a valuable endorsement of its economy and its efficiency.

In the business of a big retail store like Marshall Field's local transportation assumes unusual importance. If motor wagons are used they must be soundly constructed and dependable in every way. The firm cannot afford to take risks in delivery. The machines must operate with precision and constancy. Even occasional interruptions to service, resulting from inferior design or materials, can cause heavy loss to the company and great inconvenience to its customers.

The two Marshall Field units are working smoothly and economically. They perform the work of twelve horses. Any one can infer the saving in drivers' wages. The other economies are equally plain. The duty of the machines is to make trips to Evanston and Oak Park, suburbs of Chicago, carrying trunks packed with merchandise, which is later distributed by means of horse drawn wagons. To get this merchandise to distant outlying points, with as little delay as possible, and to guarantee punctuality in the service, was the problem. The employment of "Frayer Miller" motor trucks solved it.

There are some features of "Frayer Miller" motor truck construction which are superior to anything found on the market. We enumerate a few:

1. **Blower cooling. (No troubles from freezing.)**
2. **Great strength. (No risk from occasional overloading.)**
3. **Abundance of power. (No chance to overtax the engine capacity).**

Actively worked our three ten-ton trucks will often haul as much as five-ton machines.

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The Power Wagon

A Journal for Those Employing Commercial Motor Vehicles

No. 50 **JANUARY, 1909** **No. 50**

PUBLISHED THE FIRST OF EVERY MONTH BY

THE POWER WAGON PUBLISHING CO.

SUBSCRIPTION RATES:

One Year (Domestic)	$2.00
One Year (Foreign)	3.00
Single Copies	.20

PUBLICATION OFFICES:
THE METROPOLITAN BLOCK
Chicago, Illinois.

Advertising Rates on Application

WALTER WARDROP, Editor

Entered as Second-Class Matter December 2, 1907, at the Postoffice at Chicago, Ill., Under the Act of Congress on March 3, 1879.

Free Movement in Buying.

Remarkable liberality is now shown in large cities with respect to motor wagon purchase.

NEVER in the history of the commercial motor road vehicle has there occurred a period when machines were purchased as great freedom as we witness today. Confidence in their superiority is a characteristic of the hour.

This statement, which can be readily verified, is all the more remarkable considering how feebly business life has pulsed during the past twelve months. It may not be a reliable sign of restoration to normal that business houses of the highest rank should be found buying motor wagons, but at least it will be conceded that in doing so they are very hopeful of the future. It is equally pleasant to reflect that they do not despair of the economy of the machines.

Secretly or openly, according to his temperament, every team owner has constantly and prayerfully hoped from the beginning that the motor wagon would establish such a record of usefulness and economy as to compel a conversion of investment in other forms of transportation. It has taken time to accumulate trustworthy evidence of the machine's great service and spread it broadcast. Experts knew that it existed years ago, despite the manifest shortcomings in the engineering of the machines. They were well aware that horse transportation was so inferior that it did not require the contrast of super-excellence in motor wagon design to make it any more apparent. The economy of motor wagon haulage is relative. Eliminate horse transportation and the cash merit of the machine, now at its height, will become conspicuously less.

* * *

Enough proof of the reliability, efficiency and superior capacity of the motor wagon is now available to convince the most stubborn that it is the best instrument yet devised for local haulage. The daily service of thousands of machines, annually carrying millions of tons of merchandise, is one of the most compelling forms of this testimony. Nothing could be more persuasive for those who are considering investment. Undoubtedly it is the great activity of the motor wagons now in service which urges establishments whose transportation departments are not so furnished to make haste in acquiring such useful vehicles. Example that is so well diffused can hardly fail to be contagious.

* * *

In Chicago, especially, is the installation of motor wagons occurring with gratifying frequency. The trading record of the past two months fairly bristles with important transactions. Many houses which in the past have been regarded as passive to the introduction of the machine have lately come into the market, not as seekers of enlightenment concerning its economy, but as buyers whose decision has been compulsorily influenced by observation of what others are doing.

Motor wagon makers, rich in fancy and sure of their market, have patiently awaited the coming of the time when their splendid faith in the commercial worth of their product would be communicated to the masses at large. That period cannot now be very distant. Marshall Field, Armour, Swift, Cudahy, Standard Oil, the proprietors of the leading daily papers, the operators of big coal companies, warehousemen, brewers, railway companies, building contractors—these names and callings suggest the class of custom which has recently been won over to the active support of motor road haulage. Yesterday these converts were indifferent. Today they are ardent in their praise of

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the machine and its work. And what is happening in Chicago is being observed in every other large city.

It is no exaggeration to say that the sales registered in Chicago since election day already exceed in volume and money worth the total for a year previous. The behavior of these machines being discounted, it is certain that hundreds more will soon be bought. Even now, if delivery could be made as rapidly as customers desire, the product of a few factories would be quickly exhausted. But production lags behind demand.

* * *

A curiously instructive bit of trade history here comes to mind. About two months ago the manager of one of the wealthiest and largest retail establishments in the country, located in Chicago, visited the factory of a well known maker and offered to place an order for 50 three-ton trucks, complete delivery to be made within ninety days from date of acceptance. In declining the contract, the gross value of which was about $175,000, the factory manager explained the impossibility of producing with such rapidity. The buyer departed with the promise that a month would be given for reconsideration of this decision. At the expiry of the option the maker asked that a year be allowed for construction. This request was denied, negotiations were broken off, and a smaller number of machines was bought elsewhere.

What caused the rejection of an order so valuable? One well informed upon existing trade conditions will have no difficulty in making correct reply. Firstly, no maker is anxious to sell so much of his product to one customer unless he is assured that the installation will gain him reputation equal to what he might expect from a wider distribution. In these days of relatively low production it is not considered good policy to sell the bulk of a factory output to one concern. Such a practice deprives the maker of advertisement, narrowly confines his trade relations, and gives competitors easy access to the larger market. In the second place, all manufacturers know that it is not the initial installation which secures the permanency of their business. Fifty separate sales, each comparatively unimportant, will very probably establish connections which in a year will cause the factory output to be increased to 150 machines, and progressively thereafter. Producing for one concern is a perilous undertaking if the seller and buyer should happen to disagree. The field of commerce is strewn with wrecks caused by adhesion to such a policy.

* * *

Hence it appears that an establishment employing large numbers of horses cannot convert its transportation equipment as fast as it may desire. This is a form of restraint which will come as a surprise to a good many firms which cherish expectations of making the exchange at their own convenience. Motor wagon product has always been scarce. For some time to come its scarcity will increase with the growth of the demand, which will be much more active in a short time than it is just now. Evidently, then, the concerns which now use machines have succeeded in forming trade alliances which will become of great importance as time passes. Makers prefer to sell firms which have acquired some experience in motor wagon use. Such sales are accomplished with least expense and labor, and the risks of installation are minimized. Greatest resistance and expense is encountered in overcoming the indifference of the unenlightened. If the latter could be influenced by a few words we would urge them to get to cover as soon as they can. They will very likely find it extremely difficult to do so if they delay much longer.

TO COMMISSION 1100 MOTOR WAGONS.

ARRANGEMENTS have been made between the Hart-Kraft Motor Company, of York, Pa., and the Post Motor Company, of New York, whereby the latter establishment will undertake to put 1,100 gasoline wagons, made by the former, in service within a radius of 50 miles from the metropolis. The maintenance of these machines will be undertaken by the Post company, which will lease them on yearly contracts to establishments which have need for their services.

The Post company has been granted exclusive selling privileges within the metropolitan district. It is composed of George W. Post, Jr., formerly sales manager for the Panhard company, and C. R. Mabley, formerly a member of the firm of Smith & Mabley, and several other people well known in the trade. It is reported that already a considerable number of prominent houses in New York have agreed to sign contracts for the services of the machines.

QUARANTINING MOTOR TRUCKS.

THE prevalence of hoof and mouth diseases among animals has recently led to the enactment of a most extraordinary prohibitive measure by the Canadian authorities. At the beginning of this month motor trucks were refused permission to cross the ferry from Detroit to Windsor, it being charged that, as they have been doing a lively business in the transportation of hides and other animal products, their service was a distinct menace to Canadian animal health. Automobiles of other kinds than those used for commercial services are only permitted to cross from Detroit to Canada after they have been thoroughly cleansed of mud and dirt. The collector of customs at Windsor states that the quarantine measure will only be in force for a short time.

A British firm is building two hundred 10 hp., two cylinder gasoline motor cabs which are worm driven, the worm being placed on top of the worm wheel on the differential axle. Camshaft gear, clutch and speed change gear are housed in one casing.

Motor cabs are sold in Germany on the installment plan. Many manufacturers object to this policy, alleging that it leads to stagnation in engineering improvement.

One of the motor cab companies operating in New York City has assigned 100 machines for duty in Brooklyn.

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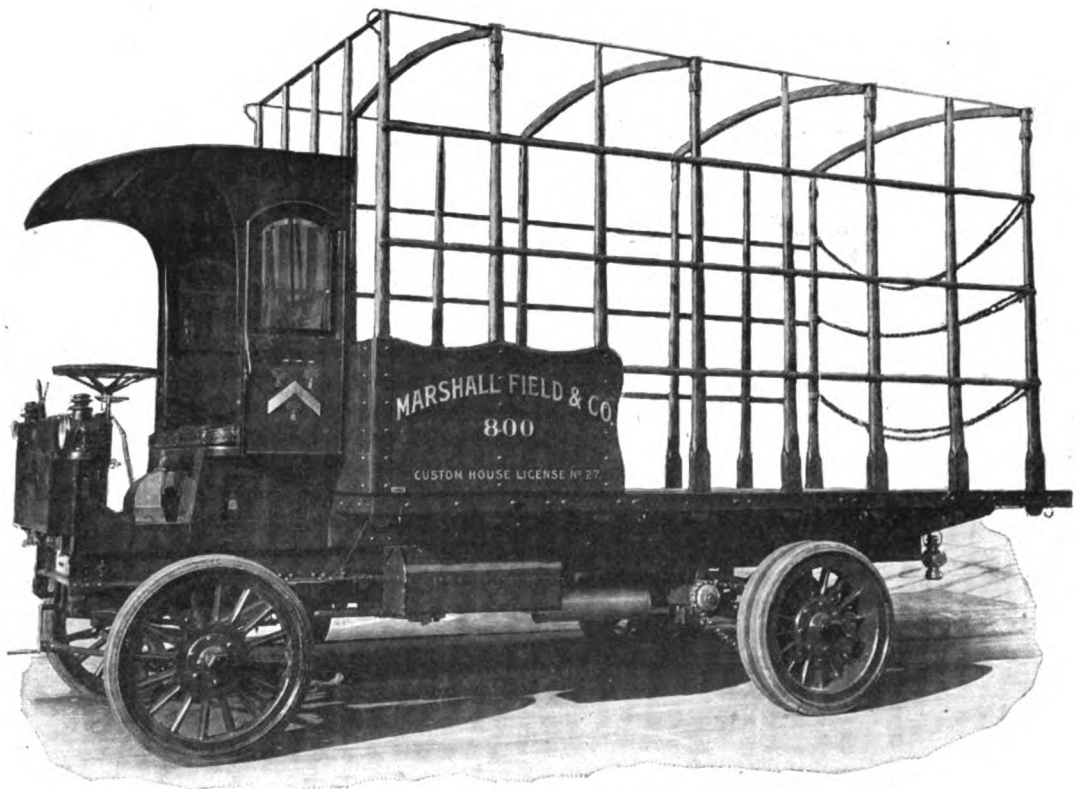

One of Marshall Field & Co.'s three-ton trucks used in making deliveries to outlying districts.

Marshall Field & Co. Buys Motor Trucks.

Two three ton machines commissioned to haul trunk-packed merchandise to Chicago suburban centers.

IT is extremely probable that Marshall Field & Company's recent purchase of two large gasoline trucks, used in delivering dry goods merchandise to Chicago suburban districts, will inspire the proprietors of other large local retail establishments to make a closer investigation in the economy of the machines than they have done in the past.

The transportation department of Marshall Field & Company is not wholly unfamiliar with the general subject of motor wagon haulage. For some years past it has employed a heavy duty electric machine which, within the limitations of the service for which it is fitted, has given fair satisfaction. But its speed and radius prohibit its being used in fast long haul work. It must be said in excuse of the shortcomings of this machine that the administrative plan upon which it is maintained is far from being ideal. To speak the truth, it is exceedingly amateurish, no provision whatever being made for extra batteries. Consequently the mileage of the machine shows a steady deterioration throughout its battery life.

* * *

The transportation department of a large establishment like Marshall Field's, in order to be commercially successful, must be operated with extreme precision. There are periods in the year when every vehicle which the firms owns is taxed to the utmost. At such times the pressure of traffic is so great that it becomes necessary to resort to unusual expedients in order to insure prompt distribution of merchandise. Obviously, it is not considered expedient to send slow moving horse drawn vehicles from the heart of the city to remote points in the suburbs, since the running time consumed by such vehicles, whether hauling light or heavy loads, would render their use uneconomical. Mass transportation to the edges of the city by means of wagons hauling large loads and redistribution from those distant points, has been the method practiced for a good many years. Formerly it was the custom to employ horse drawn vehicles in service of this sort, loads, averaging in the neighborhood of three or four tons and packed in trunks containing small packages, being distributed from Evanston, Oak Park and Hyde Park, representing the centers of population in the three great suburban divisions of Chicago on the north, west and south sides respectively. When the horse drawn vehicles reached their destination the trunks containing the merchandise were unpacked and the packages redistributed among fleets of lighter wagons which covered the territory to which they were assigned.

* * *

Until the advent of the motor truck this method of suburban distribution was considered as an exceedingly high refinement in transportation practice. The superior speed of the motor wagon, however, enabled it to outclass horse transportation in this special branch of work. As has already been intimated, the first experiment made by Marshall Field & Company was with an electric ma-

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chine, the road speed and travel range of which are inferior to those of the gasoline trucks which the firm now employs. The electric machine, however, has not been retired from service on account of the addition to the firm's installation. It is performing work which is better suited to its capacity and radius in action.

* * *

The average daily haul of the firm's gasoline trucks, which, by the way, were made in the factory of the Oscar Lear Automobile Company at Springfield, O., varies between 60 and 70 miles. One of the machines runs between the center of the city and Evanston. The other transports its loads to Oak Park. For the present the electric wagon carries supplies to the south side. Evanston is 12 miles distant from the center of Chicago. Oak Park is 10 miles distant. During the stress of the recent holiday season both gasoline machines frequently made four round trips daily, with trunks packed to the top guard, which is seven feet higher than the wagon platform. The machines went into service on November 19. Each is capable of carrying 36 trunks, which usually means a net load of about three tons, with an occasional overload as high as 50 per cent. As was the case when horses were employed in this service, the redistribution from the supply machines is accomplished by means of light horse drawn wagons.

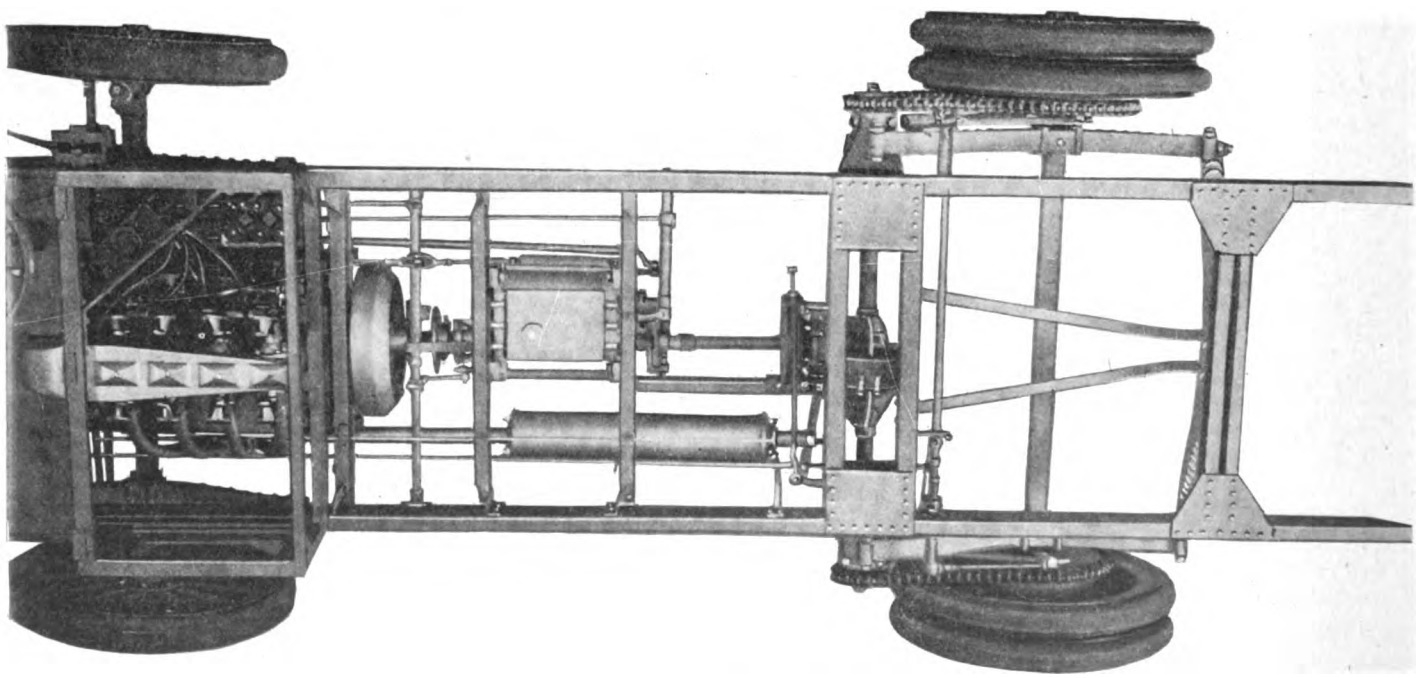
The crew of each of the gasoline motor motor wagons consists of a driver and a helper. The normal road speed of each wagon is 12 miles per hour, which is twice as fast as the firm's electric truck can travel and about six times faster than equivalent loads can be drawn by horses. When to this information is added the statement that the two gasoline machines are performing the work of 12 horses, or three four horse teams, it is easy to infer that the saving in wages and maintenance, and the gain in speed and total tonnage, represent a handsome interest on the investment.

* * *

The maintenance of the machines is not undertaken by Marshall Field & Company. Adams & Engs, the local agents of the Oscar Lear Automobile Company, attend to that important feature of administration. The agents of the makers, however, do not wholly control the service of the motor trucks. The drivers are employed by Marshall Field & Company. Every evening they report to the agents' garage with a record of work performed. The machines are then carefully inspected and put in condition for the next day's operations. For this garage service no fixed price is charged, the severe duty to which the machines are put making it practically impossible to guarantee cost of maintenance. All repair work is charged for at regular machine shop prices. Supplies and repair parts are not billed at fancy prices. Thus the cost of the service is as reasonable as could be expected considering that the owners of the machines do not themselves undertake maintenance. It is highly probable that by the time Marshall Field & Company have had a year's experience with maintenance of this sort they will be ready to assume all the obligations of those who invest heavily in motor trucks, owning their own garage, employing competent repair men, buying supplies and replacing worn parts at minimum cost. At present the service may be considered unnecessarily expensive since it affords a profit for those who attend to maintenance. This feature of expense, however, is discounted by Marshall Field & Company, who are much more concerned in observing how high a service efficiency experts can maintain than in trusting to the haphazard methods of a horse stable administration which is unfamiliar with the best practices for caring for motor wagons.

* * *

Repair and maintenance costs have been unsually light since the machines were first commissioned. This might naturally be expected, as, given sound construction in the original instance, the first few months of service should really tend to sweeten the operation of the engine and other parts which have to be broken to efficient service by wear. If at the expiration of a year the tonnage hauled



Chassis of Marshall Field & Co.'s gasoline truck.

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by these machines has not cost more than an equivalent drawn by horses it will be fair to assume that mechanical haulage has been a success. That such is the anticipation of the owners is indicated by their willingness to purchase 25 such machines if the work of the first two shall perform according to expectations.

* * *

Marshall Field & Company are very much in earnest in this undertaking. Doubtless their executives have observed the freedom with which large dry goods concerns in nearly every large city in the country, especially in the east, are using motor trucks. An installation of three motor wagons is really inconspicuous in a field where the employment of 25 such machines by individual firms is not uncommon. Chicago's premier dry goods establishment has held back from motor wagon investment longer than the majority of those who are posted upon the subject of mechanical road haulage thought possible. In a general way it has been known that the firm has delayed extensive purchase in the belief that great engineering developments were at hand. As, however, it becomes plain that it is the present day use of the engineering the market affords which really counts, it is reasonable to suppose that thoughts of getting the "perfect" machine have been dismissed.

* * *

As a class Chicago's dry goods merchants are very much less progressive in the selection of transportation means than their brethren elsewhere. This is all the more remarkable since Chicago, viewed in its physical aspect, is the best city in America in which to demonstrate the economy of motor wagon haulage. Its unusual proportions of length and breadth—the city is 26 miles long and 14 miles wide—and the rapidity with which the outlying districts are being settled, make it an ideal theater for the performance of machines. Regarded strictly from the standpoint of firms which have to deliver large quantities of dry goods merchandise, the use of no other vehicle than the motor wagon is justified. The large establishments in Chicago are continually losing trade because the horse transportation which they employ for the convenience of customers is inadequate for its purpose. It is a matter of common occurrence for merchandise to be purchased of such stores one day and for the customers not to obtain deliveries for three and sometimes four days thereafter. This is especially true at the busy season just ending. Speed and promptness in delivery is everything in the conduct of a large retail dry goods house. Transportation is perhaps the most important feature of such a business, outside of purchase.

* * *

The normal load capacity of the Marshall Field gasoline wagons is 6,000 pounds. The machines will conveniently take care of a 25 per cent overload. The engine rating is 24 hp. The characteristic of the engine is its method of cooling, which is accomplished by means of a blower. The engine, which has four cylinders, is placed underneath the driver's seat. Four forward speeds and one reverse are provided. The wheel base is 128 inches. The track is 60 inches. Transmission is effected by means of a sliding train of gears. The drive to the road wheels is effected by means of side chains from a jackshaft. Three brakes are fitted. The platform area is 6½ feet wide and 13 feet 9 inches long. The front tires are 36x4 inches. The rear tires are 36x3½ inches, dual pattern. The platform height is 42 inches. The fuel tank capacity is 16 gallons.

TEN TON GASOLINE TRUCK.

NOT infrequently it happens that the load-carrying capacity of a five-ton motor truck is found insufficient to effect any economy in short hauls. The service of a much larger unit is necessary if horses are to be displaced in such work. Even where the hauls are comparatively long it is sometimes apparent that high loads must be carried if the machine is to be operated more cheaply than horse-drawn vehicles.

To satisfy the special needs of those who find it imperative to transport great loads at relatively slow speed the Hewitt Motor Company, of New York, has built a ten ton gasoline truck. This machine is the first of its type and rating to be seen in this country. Its leading structural features will be described in the next issue of this paper.

WHOLESALE SUPERSESSION OF HORSES.

AFTER three years of careful investigation of the comparative advantages, both in economy and efficiency, of mechanical and horse drawn fire vehicles, the municipal council of Paris has decided to abandon the use of the latter within the confines of the city proper.

Experience with trial machines has demonstrated that the new service will cost $17,400 a year to maintain. The sum of $60,000 is annually required for maintaining the present horse drawn equipment, which consists of 76 vehicles. In order to make the cost of supersession as little burdensome as possible the authorities have ordered that it be accomplished within a period of six years.

CENSUS OF MOTOR BUSES IN LONDON.

AT THE last count it was found that there were 1,080 motor buses in London. The distribution was as follows:

Vanguard Company	386
General Company	287
Road Car Company	225
Great Eastern Company	79
Thomas Tilling	36
Steam Omnibus Company	20
Electrobus Company	20
Central Company	16
Miscellaneous owners	11
Total	1,080

At a recent meeting of the Ocean City (N. J.) common council the sum of $5,000 was appropriated for the purchase of a motor hose and chemical wagon.

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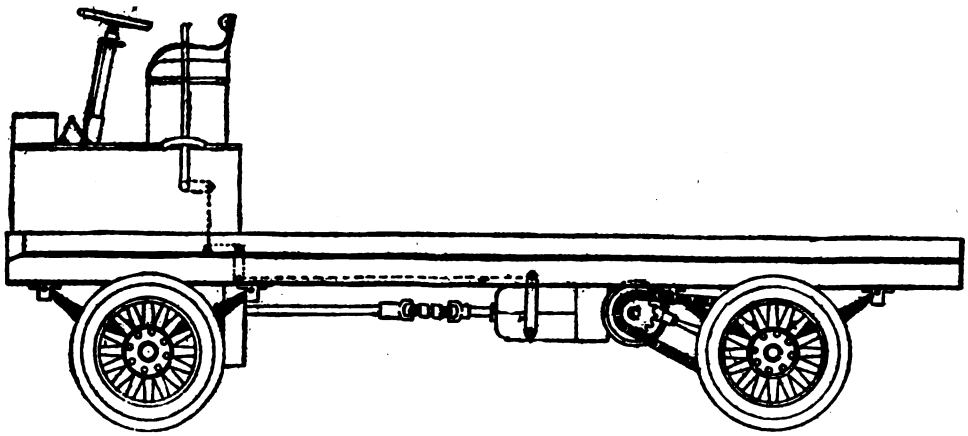
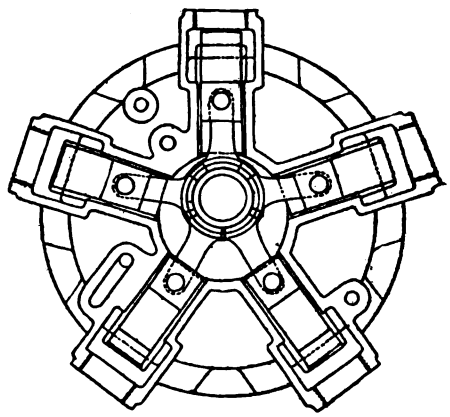




Manley's hydraulically driven wagon and its five-cylinder oil pump.

Truck With Hydraulic Transmission.

Charles M. Manley's machine, in which oil is the fluid employed in transmitting power.

FOR eighteen months past a motor truck has been hauling loads in and around New York City, the power transmission of which seems to have evoked no especial comment despite its novelty and unusual efficiency. The machine, loaded, weighs about 8,600 pounds and is devoid of clutch, change gears, differential and brake. Power is hydraulically transmitted. It is the invention of Charles M. Manly, who for many years was attached to the Smithsonian Institution at Washington. The vehicle represents almost ten years of patient investigation and experiment.

* * *

In this machine the hydraulic transmission system supersedes all the mechanism that is usually interposed between the engine and rear wheels of a gasoline wagon. Only one control lever is employed. When this lever is in neutral position the vehicle can neither be moved forward nor backward. All speeds are regulated by the use of the control lever, a forward motion giving a forward speed, and a movement to the rear a reverse speed. The vehicle is fitted with a 16 hp. engine. Its loads have been rock sand and gravel, materials which, from their lack of resilience when packed by jolting over streets, have been well calculated to test the efficiency of the new method of applying power and, in fact, the soundness of the whole vehicle structure. In all its months of service the hydraulic transmission system has responded to the wishes of its designer.

The Manly transmission is an arrangement of a "master" pump and one or more motors. Oil is used instead of water because it lubricates and does not freeze. The oil fills every case and requires renewal infrequently. With the testing truck less than a pint a week, added before beginning the week's work, has proved sufficient. The motors, which are duplicates of the pump as to size of cylinders, are not adjustable, but give results in harmony with the stroke of the pump.

* * *

The drive consists essentially of three units—a pump, the shaft of which is coupled directly to the engine shaft, and two motors, each connected by a chain and sprocket to one of the rear wheels.

The pump consists of a stationary casting, which in this present machine comprises five cylinders radiating from a round crank chamber. Mounted in each of these five cylinders is a piston, all connected by rods to a single crank pin. Formed in the main casting by the side of each cylinder is a chamber containing a valve, and all five of these valves are connected by their rods to a single crank which is driven directly by the pump crank.

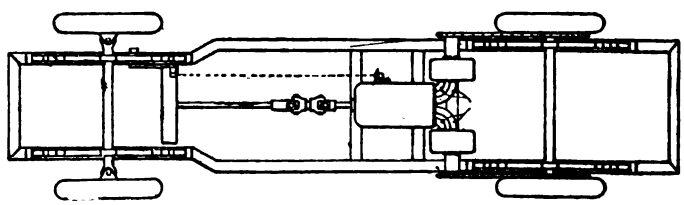
Each of the motors is exactly like the pump, except that the stroke of the crank of the motors is greater than that of the pump. The crank shaft of the pump, being directly connected to the engine crank shaft, always runs at the same speed as the engine shaft.

The variations in speed of the truck wheels are produced by varying the length of stroke of the pump crank, this crank being of a special construction permitting the length of stroke of its crank pin to be varied from a maximum through all lengths of stroke down to zero, in which latter case, of course, the crank pin is concentric with the crank shaft and, therefore, when in this condition rotation of it produces no motion of the pump pistons.

* * *

The length of stroke of the motor crank is not variable, and it is necessary therefore to furnish a definite quantity of oil to cause the motor to make one complete turn of its crank shaft. Each of the motors having a crank stroke twice as great as the stroke of the pump crank, and there being two of them, when the pump is adjusted to its maximum stroke the pump crank must make four revolutions in order to revolve both motors one revolution.

If the pump crank is adjusted to one-tenth stroke it must then make forty revolutions in order to pump enough oil to make the two motors make one revolution, and similarly if the pump crank is adjusted to one one-thousandth stroke it must make four hundred revolutions in



Plan view of Manley's hydraulically driven wagon.

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order to cause the two motors to make one revolution. By this means the variation in the length of stroke of the pump crank controls the speed of the truck wheels.

If this were all the control given by the mechanism it would be necessary, of course, to have a reverse gearing for causing the truck to run backward, but by a simple method of connecting the pump valve crank to the main pump crank reverse speeds are obtained by continuing the adjustment of the pump crank through zero to the opposite side; and while, if it were desired, all speeds in the reverse direction up to the maximum speed could be obtained, yet in practice the drive as applied to trucks is so constructed that it is not possible to run the truck backward at a speed greater than one-quarter the maximum forward speed.

Many attempts have previously been made to construct a variable speed transmission, using a hydraulic pump and motor as a basis, but in practically all experiments the variation in speed has been produced through by-passing a part of the fluid from the pump and sending to the motor only such an amount as would cause it to revolve at whatever speed was desired. The fatal error in such arrangement was that the fluid which was by-passed represented just so much engine power wasted and therefore the pulling power of the vehicle was no greater at low speeds than at high speeds.

With the Manly drive no by-pass is used, the speed being controlled by varying the stroke of the pump and thus varying the amount of fluid put into circulation; and since at short stroke the same engine power is able to pump against an increased length of stroke, the hauling power of the vehicle is increased in exact proportion as the speed is decreased, the pressure of the fluid at one-tenth speed being ten times the fluid pressure at high speed.

Motor buses are running between Douglas and Courtland in Arizona.

MANY MOTOR CAR COMPANIES FORMED.

DURING the past month the following motor cab companies have been formed:

New Orleans Taxicab Company; capital stock, $200,000. Will operate 100 machines. Organized by W. E. Woodward, of New York, who has formed similar companies in other large cities.

Citizens Taxicab Company, Cleveland, Ohio; capital stock, $50,000.

Savoy Auto and Taximeter Cab Company, New York City; capital stock, $30,000.

Greater New York and Suburban Transportation Company; capital stock, $25,000.

Lackawanna Automobile and Taxicab Company, Scranton, Pa.; capital stock, $10,000.

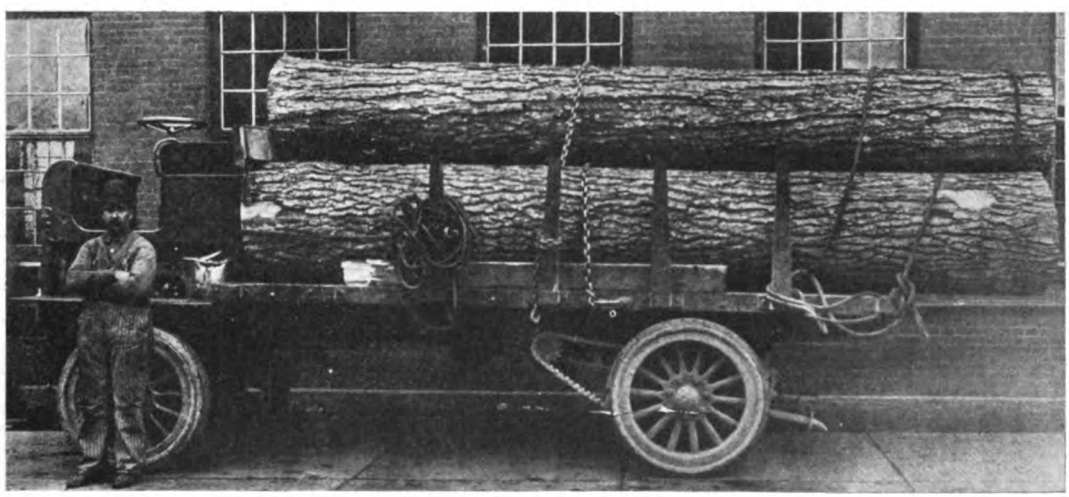
Kayton Taxicab and Garage Company, New York City; capital stock, $100,000.

In addition to these incorporated concerns it is learned that motor cab companies are being formed in Denver, St. Louis, San Diego, Calif., and Wheeling, W. Va.

CARRIAGE COMPANY TO MAKE MOTOR WAGONS.

THE Martin Carriage Company, of York, Pa., one of the largest vehicle making establishments in the state, will soon begin the manufacture of gasoline motor wagons. The company has unbounded faith in the future of mechanical haulage, especially in larger cities.

A company is being formed to operate 2,000 British made motor cabs in London within the next twelve months. Members of the Du Cros family, well known to many automobile tradesmen in this country, are promoting the enterprise and will be the principal investors in it.



Heavy Load of Lumber.

The picture shown above illustrates the severe work to which motor wagons are occasionally put. The machine is the product of the American Motor Truck Company's factory at Lockport, New York. The load consists of three green maple logs, three feet in diameter at the butts and 14 feet in length. This immense load was hauled from Belleville to Watertown, New York, a distance of 40 miles, over country roads from the timber tract where the logs were cut. The way was rough and hilly. The journey was made in 6½ hours actual running time, most of it after dark.

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The Sternberg wagon nearing Chicago, on its way from Milwaukee.

From Milwaukee to Chicago Through Snow.

Friction driven delivery wagon, made by the Sternberg Mfg. Co., in a test of great severity.

UNDER normal winter weather conditions it would be considered something of a feat to drive a motor wagon, rated to carry a ton, from Milwaukee to Chicago. The roads are in execrable condition, containing deep walls of mud which are frozen solid, making the passage of any vehicle exceedingly difficult. When, however, such a journey is accomplished while the roads are covered with snow, and the path obscured from view, it is quite evident that the efficiency and dependability of the machine have reached a high point of development. The one ton gasoline machine which has recently issued from the shops of the Sternberg Mfg. Co., of Milwaukee, was given its trial under the conditions last mentioned. As it came through without the slightest mishap of consequence the makers are naturally much elated over its performance.

So far as memory serves this is the first trip of this character ever undertaken by a friction driven wagon. If similar journeys have been performed there is no authenticated record of them. The conditions under which the transmission device of the Sternberg wagon functioned were exceedingly severe.

* * *

For a good many years the opinion has prevailed in amateur and professional circles that a friction driven motor wagon could not show any marked degree of efficiency if the discs of the transmission were not kept scrupulously clean. It has even been asserted that moisture would cause a notable loss of power by causing the discs to slip in their revolutions. The trial of the Sternberg machine completely disproves these theories and establishes a record of great importance for those who are less inclined to consider the mechanical engineering of a motor wagon than its economy.

From Milwaukee to Racine, a distance of about 25 miles by road, the snow was unusually deep, having drifted over the prairies. The friction wheel, which has a clearance of 14 inches from the ground, continually left its mark on the top of the snow. It is quite evident, therefore, that at all times throughout this stage of the journey the transmission device, which was purposely left unenclosed, was operating in a cloud of snow particles, and, remembering the unyielding and uneven character of the roadway itself, it is further apparent that no appreciable loss of power could have resulted. In ordinary commercial practice, however, the transmission of the Sternberg wagon is enclosed.

* * *

A brief account of the incidents of the journey from Milwaukee to Chicago will not be without interest to those who may have occasion to consider how superior the work of a motor wagon is under conditions which are best calculated to most severly test its capacity. Assuming that any commercial house would be so foolhardy as to start horses on such a trip, it is highly probable that they would never reach destination. Certainly the first stage of the route would have tested their powers to the utmost. If they had succeeded in getting to Racine, they would have been so exhausted as to have been unable to proceed with-

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out a long rest. Fortunately for the credit of horse transportation it has not been regarded as practical to put animals into such service. Some mechanical means of transportation, the trolley, the steam railway, or the motor wagon, comes to the rescue in such a situation and relieves the horse of the unsupportable charge of inefficiency. With the passing of each year there is more and more demand for the service of a motor vehicle in work of this character. Bus service, for example, is now furnished throughout the year despite hostile climatic conditions. Interurban motor wagon transportation, too, is no longer conducted under fair weather conditions. The machine is for all purposes and all seasons.

* * *

The Sternberg wagon left Milwaukee at 11 o'clock on the morning of December 6. Snow was descending thick and fast, which made it difficult for the driver to observe the course. The use of goggles was out of the question, as the snow clouded the glasses the moment they were put in use. No trace of the roadway could be observed between Milwaukee and Racine. The motor wagon was the only vehicle on the road, and it was evident that many hours had passed since any other vehicle had preceded it. Consequently the way was blind. A further handicap to progress was the driver's lack of acquaintance with the road. He had never been over it before. The three passengers who accompanied him were no better informed. The week before the trial there had been heavy rains and considerable vehicle traffic. As a result the road was full of deep ruts which, when freezing weather ensued, presented hard walls and unusually formidable difficulties to the passage of the machine. The passengers had all they could do to retain their seats, so severe was the jolting from the unseen obstacles. Under such circumstances it is not surprising to learn that this part of the journey was accomplished at second speed. Exclusive of the passengers, the load carried was 1,200 pounds of freight. The four passengers, including the driver, averaged about 800 pounds more, making a net load of one ton.

Racine was reached four hours after the start had been made. One hour and a half was spent in drying clothes and eating lunch. Waukegan was reached at 6:15 in the evening. From that point onward the roads were found to be in much better condition than at the outset, and, except for the fact that it was necessary to stop in order to inquire the way to Chicago, tolerably rapid progress was made. Half an hour was taken in Waukegan for supper. Chicago was reached at 9:30 at night.

* * *

Throughout the trip no adjustments were made to working parts. The engine never hesitated and at all times there was an abundance of power to overcome the impediments in the way. Considerable time was lost, however, in repairing broken tire chains. The driving wheels were wrapped in order to improve the traction. The hardness of the ruts played havoc with these chains, breaking them in seven places, despite the fact that they were constructed of exceptionally heavy material. All told, fifty minutes were lost in making repairs of this kind.

The recording instrument showed that the journey of 102 miles had been made in 7 hours and 40 minutes, net running time, including voluntary stops for the purpose of ascertaining the course. This gave an average speed of about 13 miles an hour, which, considering the extraordinary difficulties which were encountered in the course of the journey, is a record of which the manufacturers have every reason to be proud. The fuel consumption amounted to 12 gallons. The lubricating consumption was half a gallon.

The work following this notable trip was spent in demonstrating the machine in Chicago, where several sales of importance were made upon the strength of the brilliant performance just narrated.

* * *

The Sternberg wagon is made in two sizes, one for light delivery and the other for light trucking. The following specifications apply to the light machine: The motor is a water cooled, two cylinder engine, fitted with mechanical oiler. It develops 20 hp. The capacity of the fuel tank is 25 gallons. The final drive is by side chains from jack shaft sprockets. The transmission is of the single disc variety, the diameter of the fibre friction being 24 inches and the face of the fibre being 1½ inches. The driving disc is made of alloy metal. A large ball-bearing collar is fitted back of the friction disc. The machine is supplied with three brakes, two on the rear wheels and one on the jackshaft. The springs are long semi-elliptic in front and full elliptic in the rear. The rear axle is 1⅝ inches square. The front axle is 1⅜ inches square. Both axles are fitted with roller bearings. The steering gear is of the worm and nut type. The wheels are all metal. The tire dimensions all round are 36 by 2 inches. The wheel base is 88 inches. The gauge is 56 inches.

The engine fitted to the one ton truck develops 24 hp. The tires of this model measure 34 by 3 inches in front and 34 by 3½ inches in the rear.

FROM PONTIAC TO NEW YORK BY ROAD.

WITH the expectation of reaching New York City in time for exhibition at the first automobile show the Rapid wagon which transported the baggage during the last Glidden tour was dispatched from the factory on the morning of December 20. The route was by way of Toledo, Cleveland, Erie, Buffalo, Rochester, Syracuse and Albany. The machine has not been repaired since it returned from the Glidden tour, at which time it was taken apart and its parts calipered to ascertain to what extent they had become worn. The examination revealed the fact that what wear was noticeable was of an unimportant character, and consequently the machine was regarded as fit for another long and arduous trip.

The operators of the motor bus service between Tonopah and Clifford, Nev., are guaranteed against loss by the citizens at both ends of the line. Thus far, however, the service has been self-sustaining. Mail, passengers and light express matter is transported.

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Rubber-Asphalt Pavement.

Examples of its use and a description of the methods employed in compounding and laying.

IN the last issue of this journal the potential value of rubber as a street surfacing material was indicated by a brief comparative study of its cost of maintenance and durability. In the course of the article on the subject allusion was made to the service afforded by some strips of ground experimentally laid with compounded rubber. Lack of space prevented us from giving an extended description of the nature and value of these improved roadways. To repair this omission is the present purpose.

* * *

For six years past rubber-asphalt has been used as an experimental pavement in several cities in France, notably in Paris and Lyons. So far as can be ascertained the results obtained have been very satisfactory. In the city of Marseilles a satisfactory experiment was made upon the Prado a number of years ago, and this spring three or four public places were similarly paved, these areas, however, being devoted to pedestrian traffic exclusively. Innovations of this kind make slow progress in France, but from the character of the men who are introducing the new pavement and the increasing importance of the work undertaken, rubber-asphalt paving must be regarded very seriously as a substitute for the more usual form of asphalt paving.

At the present time most asphalt paving involves the use of costly installations for the heating of the powder, a considerable amount of material, and a special class of laborers, all of which tend to increase the cost. Under the new process it is possible to make cold applications of asphalt, which are said to possess all the advantages of hot compressed asphalt without its drawbacks.

* * *

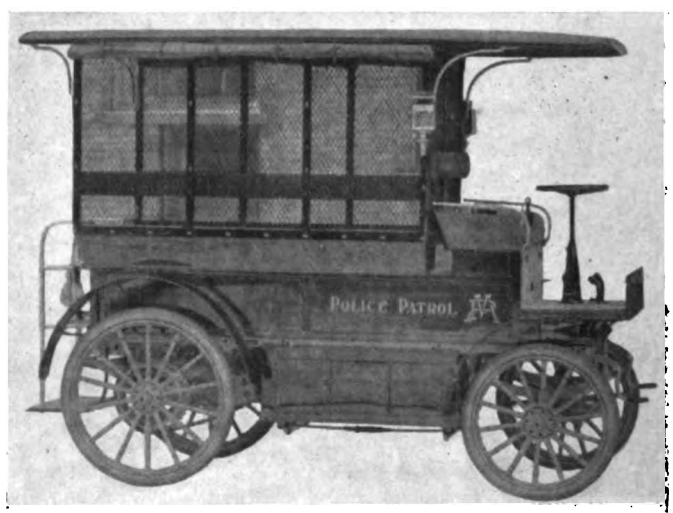
The material under description is a product resulting from the association of asphalt and rubber. Asphalt is a carbonate of lime impregnated with bitumen, with which rubber combines under certain conditions, thus effecting the cohesion of the calcareous molecules. This product is claimed to be more plastic and more adhesive than pure asphalt, and it resists higher temperatures. To obtain the combination of bitumen and rubber they must be energetically mixed in special devices in which the asphalt, reduced to fine powder, is in the presence of rubber swelled and softened by a solvent. The material thus obtained is a brown powder darker than the original asphalt, and it suffices to compress it in order that it shall set and harden rapidly. It is alleged that when asphalt is applied hot, the heat of the application, coming into contact with a concrete foundation containing more or less humidity, vaporizes the water contained therein, and the steam, by its force of expansion, escapes, thus destroying the compactness of the combination. This inconvenience does not present itself in the system under consideration, which permits the application of a much thinner layer of asphalt and one which unites itself with the concrete, constituting a solid mass. The observations of this form of pavement satisfy those interested in the subject that the completed surface resists ordinary wear more satisfactorily than any other.

* * *

Rubber-asphalt must be applied upon a foundation of first-class concrete, consisting of 440 pounds of good Portland cement and one cubic meter (35.31 cubic feet) of pebbles and sand, the proportions being one-third of sand to two-thirds of pebbles. The thickness of the foundation should vary from 15 to 20 centimeters (5.90 to 7.87 inches) and it should be rammed with the back of shovels used in this work, and given the exact form which the roadway is intended to have, without the necessity of making later additions of concrete to bring the surface to its proper proportions. The surface of the concrete should be regular, so that the layer of asphalt may have a uniform thickness. This foundation should remain three to five days, according to the season, until it has acquired a sufficient hardness to support the ramming of the layer of asphalt. The surface of concrete having been well cleaned, is covered with a thin coating of special material, which is laid on with a brush upon which the rubber-asphalt powder is lightly sprinkled. Shortly after these preliminary operations the uniform layer of rubber-asphalt powder is spread to a thickness of 3.5 to 4 centimeters (1.37 to 1.57 inches), which is compressed progressively by means of a rammer. This done, the surface may be opened immediately to travel. It is said that by this process the top-dressing of asphalt, when laid on hot, may be one-half the thickness necessary when the asphalt is laid on cold.

ELECTRIC POLICE WAGON IN ST. LOUIS.

THE police commissioners of St. Louis have purchased an electric patrol wagon. The machine will be thoroughly tested in the service of one of the district stations, and if it meets official expectations all the other stations



will be supplied with similar machines. The vehicle was manufactured by the Studebaker company. It can travel at the rate of 20 miles an hour. It has seating capacity for 16 passengers. The special body is mounted upon one of the Studebaker 1,600-pound capacity running gears.

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OUR CLASSIFIED TABLES OF MANUFACTURE.

FOR the convenience of buyers we present in this issue a number of tables which reflect the manufacturing side of the industry. It is not pretended that these tables give all the information which purchasers require. Indeed, their shortcomings are quite obvious. Nevertheless they do show the commoner characteristics of design, and thus at a glance help purchasers in the selection of machines such as may serve their business interests.

Obviously it would be well nigh impossible to supply a well articulated skeleton of all the existing forms of motor wagon manufacture in the country. While to help buyers we have followed the usual trade method of classifying models according to type and rating, it must be very apparent that, as all machines are constructed to withstand moderate overload, the ratings assigned are more or less false. They are, however, sufficiently accurate to convey working ideas to the purchasers. Load platform areas and cubical contents are matters which are usually at the discretion of the purchasers. The same, within limitations, is true of wheel base, gauge, tire and wheel equipment, extreme length over all, and platform height. Some attempt at standardization, however, must be made, and the majority of manufacturers of commercial motor vehicles endeavor to have as little variation as possible in their product.

This is the first attempt that has ever been made to classify and list in table form the producers of commercial motor vehicles of the more important types. The tables by no means include all of the establishments which are making business machines. They do, however, include all the firms which are actively manufacturing. It is quite probable that at a later day the published lists will be revised and enlarged. Any opinions which in the judgment of our readers would lead to improvement in the character of the tables will be given due consideration, and if found worthy will be incorporated in the next presentation.

ALCOHOL MOTOR CAB.

THE first alcohol motor cab has made its appearance in New York. It is the product of the factory of the H. H. Franklin Manufacturing Company, where the engineers have long been experimenting to provide an alcohol motor that would give results equal to those of the gasoline motor.

The result sought has been attained, for the engine has been tested over hundreds of miles of road before being sent out from the factory and has demonstrated a capability of covering as great a distance for each gallon of alcohol as other motors of like size do for each gallon of gasoline.

The new vehicle is of 18 horsepower and is identical with the gasoline motor cabs of the 1909 Franklin model, except for the provision made for the use of alcohol in place of the gasoline. At first experiments were made with a regular gasoline engine, but after a study of its action an engine was made specially designed for alcohol, and it is this with which the new cab is propelled. Alteration is made as to compression and carburetion. The alcohol is found to produce no bad effect upon the motor.

SUIT OVER PURCHASE OF MUNICIPAL MACHINES.

THE Johnson Service Company, of Milwaukee, has commenced suit against the authorities of that city to restrain them from purchasing a $4,000 motor driven police patrol wagon unless the sale is accomplished as required by law after competitive bids have been received. It seems that quite a few automobiles have been purchased for use in the various municipal departments without following the forms prescribed by law. In its complaint the Johnson company says that the members of the city council, having appropriated the sum necessary for the purchase, have openly announced their intention to disregard precedent and buy the machine regardless of the quotations offered by other manufacturers.

Motor Truck and Trailers.

It is not often that motor trucks are seen in this country hauling trailers, although the spectacle is common enough in Europe and Great Britain. The photograph shown above illustrates a gasoline machine, made by the American Motor Truck Company, hauling three trailers on a 5 per cent grade. The machine is in the service of C. B. Whitmore Company, at Lockport, N. Y., who are dealers in cement and other building materials. The load is divided as follows: 5 tons on tractor, 3 tons on the first trailer, 2 tons on the second and 3 tons on the third, making a total of 13 tons. The gross weight including motor truck, trailers and load, is 21 tons. The grade in question occurs between the company's warehouse and the railway station. After this grade is negotiated the motor truck draws its load at high speed on level ground. In making deliveries to the warehouse it is necessary to turn into a narrow street much like an alley. This is done without detaching any of the trailers. Such large loads are not carried with much frequency, but they are by no means uncommon, as business emergencies arise which make such heavy transportation very necessary.

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Manufacturers of Gasoline Wagons Rated to Carry from 500 to 1,800 Lbs.

Name of Maker—	Price. List	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
*American Motor Truck Co.	$1,500	1,000 lbs.	20 hp.	4 vert.	Water	3 for. 1 rev.	102 in.	56½ in.	Sliding gear	Chain	2	34x3	34x3	36 in.	12 gals.
Atlas Motor Car Co.	1,800	1,500	22 hp.	2 vert.	Water	2 for. 1 rev.	105 in.	56 in.	Sliding gear	Shaft	2	30x4	30x4	25 in.	17 gals.
Auto-Car Equipment Co.	2,000	1,000	24 hp.	4 vert.	Air	3 for. 1 rev.	110 in.	56½ in.	Sliding gear	Chain	2 sets	32x2½	36x3	36 in.	10 gals.
Brush Runabout Co.	500	500	7 hp.	1 vert.	Water	2 for. 1 rev.	75 in.	56 in.	Planetary	Chain	2	.....	.....	27 in.	5 gals.
Cadillac Motor Car Co.	950	1,000	10 hp.	1 horiz.	Water	2 for. 1 rev.	82 in.	56 or 61 in.	Planetary	Chain	1	30x3½	30x3½	36 in.	8 gals.
Chase Motor Truck Co.	750	500	10 hp.	2 vert.	Air	2 for. 1 rev.	84 in.	56 in.	Planetary	Chain	2	38x1¼	40x1¼	36 in.	7 gals.
Chase Motor Truck Co.	900	750	15 hp.	3 vert.	Air	2 for. 1 rev.	94 in.	56 in.	Planetary	Chain	2	38x1⅝	40x1⅝	36 in.	7 gals.
Commercial Motor Truck Co.	1,500	1,200	24 hp.	2 horiz.	Water	.....	84 in.	56 in.	Friction	Chain	2	34x2½	34x3	38 in.	15 gals.
Dowagiac Motor Car Co.	1,500	1,500	18 hp.	2 opp.	Water	2 for. 1 rev.	100 in.	56 in.	Planetary	Chain	..	....	.....	.....	.....
Franklin Mfg. Co.	2,000	1,000	18 hp.	4 vert.	Air	3 for. 1 rev.	83 in.	54 in.	Sliding gear	Worm	2 sets	32x2½	32x3	31 in.	12 gals.
Gaeth Automobile Co.	1,500	1,500	12-15 hp.	1 horiz.	Water	2 for. 1 rev.	103 in.	.....	Planetary	Chain	2	.....	.....	36 in.	12 gals.
Gramm Logan Motor Car Co.	1,600	1,500	25 hp.	4 vert.	Air	2 for. 1 rev.	98 in.	56½ in.	Sliding gear	Chain	4	34x3	34x3	36½ in	15 gals.
*Hart Kraft Co.	1,050	1,000	14 hp.	dbl.opp.	Water	2 for. 1 rev.	90 in.	56 in.	Planetary	Chain	2	36x2	36x2	32 in.	10 gals.
Hewitt Motor Co.	1,600	1,000	12 hp.	1 vert.	Water	2 for. 1 rev.	84 in.	56 in.	Planetary	Chain	2	32x2½	32x3	36 in.	10 gals.
Holsman Automobile Co.	700	1,000	12 hp.	2 horiz.	Air	2 for. 1 rev.	75 in.	56-62 in.	Cable	Cable	2	.....	.....	29 in.	5½ gals.
*Knox Automobile Co.	1,400	1,500	12 hp.	1 horiz.	Air	2 for. 1 rev.	85 in.	56 in.	Planetary	Chain	3	32x3	36x3	34 in.	15 gals.
Lindsley & Co.	600	1,000	16 hp.	2 horiz.	Air	3 for. 1 rev.	100 in.	48-52 in.	Planetary	Chain	2	36x1½	36x1½	30 in.	8 gals.
Logan Construction Co.	1,750	1,500	20 hp.	4 vert.	Air	2 for. 1 rev.	108 in.	56½ in.	Sliding gear	Chain	4	32x3½	32x3½	36 in.	9 gals.
Martin Carriage Works	....	1,000	16 hp.	2 vert.	Water	2 for. 1 rev.	90 in.	56 in.	Planetary	Chain	3	....	.....	34 in.	12 gals.
Olds Motor Works	2,500	1,800	32 hp.	4 vert.	Water	3 for. 1 rev.	120 in.	55 in.	Sliding gear	Shaft	2 sets	34x4½	34x4½	30 in.	15 gals.
*Randolph Motor Car Co.	1,075	1,500	22 hp.	2 horiz.	Water	.....	80 in.	54½ in.	Friction	Chain	2	34x2½	36x3	33 in.	20 gals.
Reliable Dayton Motor Car Co.	1,050	750	20 hp.	2 horiz.	Water	2 for. 1 rev.	91 in.	56 in.	Sliding gear	Chain	2 sets	40x1¾	44x1¾	54 in.	10 gals.
*Sternberg Mfg. Co.	985	1,500	18-20 hp.	2 horiz.	Water	.....	88 in.	56 in.	Friction	Chain	3	36x2	36x2	38 in.	25 gals.
Twyford Motor Car Co. (four wheel drive)	1,500	1,000	18 hp.	2 vert.	Water	3 for. 1 rev.	78 in.	62 in.	Special	Shaft	3	30x2	30x2	.....	10 gals.
Van Wambeke & Sons.	850	1,000	18 hp.	2 vert.	Air	2 for. 1 rev.	80 in.	56 in.	Chain	Chain	2	38x1¼	42x1¼	34 in.	10 gals.

*List price is for chassis only.

Manufacturers of Gasoline Wagons Rated to Carry from 2,000 to 2,500 Lbs.

Name of Maker—	Price. List	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
*American Motor Truck Co.	$2,500	2,000 lbs.	25 hp.	4 vert.	Water	3 for. 1 rev.	108 in.	56½ in.	Sliding gear	Chain	2	36x3½	36x4	40 in.	.....
Auto-Car Equipment Co.	2,500	2,000	25 hp.	4 vert.	Water	3 for. 1 rev.	120 in.	66 in.	Sliding gear	Chain	2 sets	36x3½	36x3½	36 in.	10 gals.
Coppock Motor Car Co.	2,650	2,000	36 hp.	3 vert.	Water	3 for. 1 rev.	87 in.	58 in.	Sliding gear	Chain	4	32x3½	32x4	36 in.	15 gals.
Franklin Mfg. Co.	2,200	2,000	18 hp.	4 vert.	Air	3 for. 1 rev.	83 in.	54 in.	Sliding gear	Worm	2 sets	32x3	32x3½	31 in.	12 gals.
*Knox Automobile Co.	2,200	2,500	20 hp.	2 horiz.	Air	2 for. 1 rev.	97 in.	56 in.	Planetary	Chain	3	32x3½	32x3½	38 in.	18 gals.
Lindsley & Co.	800	2,000	24 hp.	2 horiz.	Water	2 for. 1 rev.	100 in.	48-52 in.	Planetary	Chain	2	36x2	36x2	30 in.	8 gals.
Logan Construction Co.	2,250	2,000	20 hp.	4 vert.	Air	3 for. 1 rev.	96 in.	56½ in.	Sliding gear	Chain	2 sets	32x4	32x4	34 in.	8 gals.
Mitchell Motor Car Co.	2,000	2,000	20 hp.	4 vert.	Water	3 for. 1 rev.	112 in.	56 in.	Sliding gear	Worm	4	30x3	30x3	28 in.	16 gals.
*Sternberg Mfg. Co.	2,000	2,000	26 hp.	2 horiz.	Water	.....	100 in.	56 in.	Friction	Chain	3	34x3	34x3½	36 in.	25 gals.
Wilcox Motor Car Co.	2,250	2,000	30 hp.	4 vert.	Water	3 for. 1 rev.	117 in.	58 in.	Sliding gear	Chain	4	36x3½	36x3½	48 in.	15 gals.

*List price is for chassis only.

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Manufacturers of Gasoline Wagons Rated to Carry from 3000 to 3500 Lbs.

Name of Maker—	Price. List	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
*American Motor Truck	$2,750	3,000	35-40 hp.	4 vert.	Water	3 for. 1 rev.	110 in.	56½ in.	Sliding gear	Chain	2	36x4	36x5	44 in.	.....
Commercial Motor Truck Co.	2,250	3,000	40 hp.	4 vert.	Water	.....	103 in.	56 in.	Friction	Chain	2	34x3	36x4	42 in.	16 gals.
Coppock Motor Car Co.	2,750	3,000	30-36 hp.	3 vert.	Water	3 for. 1 rev.	90 in.	58 in.	Sliding gear	Chain	4	32x3½	32x3 dual	36 in.	25 gals.
Coppock Motor Car Co.	2,850	3,000	30-36 hp.	3 vert.	Water	3 for. 1 rev.	126 in.	58 in.	Sliding gear	Chain	4	32x3½	32x3 dual	36 in.	25 gals.
Gramm Logan Motor Car Co.	2,250	3,000	25 hp.	4 vert.	Air	3 for. 1 rev.	96 in.	56½ in.	Sliding gear	Chain	4	34x3½	34x3½	36 in.	15 gals.
*Knox Automobile Co.	2,600	3,000	20 hp.	2 horiz.	Air	2 for. 1 rev.	100 in.	56 in.	Planetary	Chain	4	34x3½	34x4	36 in.	18 gals.
Oscar Lear Automobile Co.	2,750	3,000	24 hp.	4 vert.	Blower	3 for. 1 rev.	120 in.	66 in.	Sliding gear	Chain	3	36x4	36x3½ dual	38 in.	16 gals.
*Randolph Motor Car Co.	2,000	3,000	30 hp.	4 vert.	Water	3 for. 1 rev.	100 in.	56 in.	Sliding gear	Chain	3	36x4	38x5	44 in.	25 gals.
Speedwell Motor Car Co.	2,500	3,500	24 hp.	4 vert.	Water	3 for. 1 rev.	120 in.	56 in.	Sliding gear	Shaft	4	34x5	34x5	39 in.	24 gals.
Sayers & Scovill Co.	2,500	3,000	20-24 hp.	4 vert.	Air	3 for. 1 rev.	100 in.	60 in.	Sliding gear	Chain	2 sets	32x3½	34x3½	36 in.	10 gals.

*List price is for chassis only.

Manufacturers of Gasoline Wagons Rated to Carry 4,000 Lbs.

Name of Maker—	Price. List	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
*American Motor Truck Co.	$3,000	4,000	40 hp.	4 vert.	Water	3 for. 1 rev.	112 in	56½ or 61 in.	Sliding gear	Chain	2	36x4	36x3 dual	44 in.	.....
Coppock Motor Car Co.	2,850	4,000	36 hp.	3 vert.	Water	3 for. 1 rev.	126 in.	60 in.	Sliding gear	Chain	4	32x4	32x3½ dual	36 in.	25 gals.
Franklin Mfg. Co.	2,500	4,000	18 hp.	4 vert.	Air	3 for. 1 rev.	100 in.	56 in.	Sliding gear	Worm	2 sets	32x3	32x3 dual	40 in.	12 gals.
Hewitt Motor Co.	3,000	4,000	24 hp.	2 horiz.	Water	2 for. 1 rev.	109 in.	60 in.	Planetary	Chain	2	34x4	34x7 dual	38 in.	15 gals.
*Knox Automobile Co.	3,500	4,000	40 hp.	4 vert.	Air	3 for. 1 rev.	125 in.	60¾ in.	Sliding gear	Chain	4	36x4	36x5	44 in.	20 gals.
*Mack Bros. Motor Car Co.	3,500	4,000	50 hp.	4 vert.	Water	3 for. 1 rev.	126 in.	68 in.	Indvl. clutch	Chain	4	36x4	36x3 dual	.....	22 gals.
Wilcox Motor Car Co.	2,750	4,000	30 hp.	4 vert.	Water	3 for. 1 rev.	126 in.	58 in.	Sliding gear	Chain	4	36x3½	36x2¾ dual	48 in.	15 gals.

*List price is for chassis only.

Manufacturers of Gasoline Wagons Rated to Carry 5,000 Lbs.

Name of Maker—	List Price.	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
Commercial Motor Truck Co.	$2,500	5,000 lbs.	50 hp.	4 vert.	Water	.....	108 in.	56 in.	Friction	Chain	2	34x3½	36x3 dual	42 in.	16 gals.
Oscar Lear Automobile Co.	3,000	5,000 lbs.	24 hp.	4 vert.	Blower	4 for. 1 rev.	128 in.	66 in.	Sliding gear	Chain	3	36x4	36x3½ dual	42 in.	16 gals.

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Manufacturers of Gasoline Wagons Rated to Carry 6,000 Lbs.

Name of Maker—	Price. List	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
American Machine Mfg. Co.	$3,000	6,000 lbs.	35 hp.	4 vert.	Water	3 for. 1 rev.	108 in.	.....	Sliding gear	Chain	2 sets	32x4	36x5 dual	40 in.	15 gals.
*American Motor Truck Co.	3,500	6,000	55 hp.	4 vert.	Water	2 for. 1 rev.	118 in.	61 in.	Planetary	Chain	2	36x5	36x4 dual	44 in.	20 gals.
Auto-Car Equipment Co.	3,500	6,000	40 hp.	4 vert.	Water	3 for. 1 rev.	.....	62 in.	Sliding gear	Chain	2 sets	36x4	36x5	39 in.	15 gals.
Chase Motor Truck Co.	3,500	6,000	30 hp.	4 vert.	Air	3 for. 1 rev.	125 in.	56 in.	Sliding gear	Chain	2	36x4	36x3 dual	48 in.	20 gals.
Gramm Logan Motor Car Co.	3,500	6,000	45 hp.	4 vert.	Water	3 for. 1 rev.	120 in.	60 in.	Sliding gear	Chain	4	36x5	36x3½ dual	36 in.	18 gals.
*Knox Automobile Co.	3,750	6,000	40 hp.	4 vert.	Air	3 for. 1 rev.	125 in.	67 in.	Sliding gear	Chain	4	36x4	36x3½ dual	44 in.	20 gals.
Logan Construction Co.	3,500	6,000	40 hp.	4 vert.	Water	3 for. 1 rev.	120 in.	60 in.	Sliding gear	Chain	2 sets	36x5	36x3½ dual	42 in	15 gals.
*Mack Bros. Motor Car Co.	4,000	6,000	50 hp.	4 vert.	Water	3 for. 1 rev.	126 in.	68 in.	Indvl. clutch	Chain	4	36x5	36x3½ dual	.....	22 gals.
Parr Wagon Co.	3,500	6,000	40 hp.	4 vert.	Water	.....	111 in.	60 in.	Friction	Chain	2 sets	34x4	36x3½ dual	45 in.	17 gals.
Packard Motor Car Co.	3,850	6,000	24 hp.	4 vert.	Water	3 for. 1 rev.	144 in.	68 in.	Sliding gear	Chain	4	34x4	34x4 dual	42½ in.	22 gals.
*Randolph Motor Car Co.	3,500	6,000	45 hp.	4 vert.	Water	3 for. 1 rev.	124 in.	58 in.	Sliding gear	Chain	3	36x6	36x6 dual	46 in.	30 gals.
Sayers & Scovill Co.	3,500	6,000	40-45 hp.	4 vert.	Water	3 for. 1 rev.	146 in.	68 in.	Sliding gear	Chain	3 sets	36x4	36x4 dual	36 in.	20 gals.
*Sternberg Motor Car Co.	3,000	6,000	40-45 hp.	4 vert.	Water	3 for. 1 rev.	120 in.	60 in.	Cotta type	Chain	2 sets	36x5	36x3½ dual	42 in.	30 gals.
Wilcox Motor Car Co.	3,000	6,000	30 hp.	4 vert.	Water	3 for. 1 rev.	126 in.	58 in.	Sliding gear	Chain	4	36x4	36x3 dual	48 in.	15 gals.

*List price is for chassis only.

Manufacturers of Gasoline Wagons Rated to Carry 8,000 Lbs.

Name of Maker—	List Price.	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
Alden Sampson Mfg. Co.	$4,500	8,000 lbs.	40 hp.	4 vert.	Water	4 for. 1 rev.	145 in.	68 in.	Sliding gear	Chain	3	36x4½	36x4 dual	42 in.	25 gals.
Commercial Motor Car Co.	5,000	8,000	30-40 hp.	4 vert.	Water	3 for. 1 rev.	153 in.	64 in.	Sliding gear	Chain	3	36x4	42x4 dual	30-42 in.	25 gals.
*Knox Automobile Co.	4,000	8,000	50-60 hp.	4 vert.	Water	3 for. 1 rev.	149 in.	67 in.	Sliding gear	Chain	4	36x4	36x4 dual	44 in.	20 gals.
*Mack Bros. Motor Car Co.	4,250	8,000	50 hp.	4 vert.	Water	3 for. 1 rev.	126 in.	68 in. front 72 in. rear	Indvl. clutch	Chain	4	36x5	36x3½ dual	.....	22 gals.

*List price is for chassis only.

Manufacturers of Gasoline Wagons Rated to Carry 10,000 Lbs.

Name of Maker—	Price. List	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
American Machine Mfg. Co.	$5,000	10,000 lbs.	60 hp.	4 vert.	Water	3 for. 1 rev.	140 in.	.....	Sliding gear	Chain	2 sets	32x5	36x6 dual	40 in.	25 gals.
*American Motor Truck Co.	4,250	10,000	65 hp.	4 vert.	Water	2 for. 1 rev.	130 in.	61 in.	Planetary	Chain	2 sets	36x7	36x5 dual	44 in.	20 gals.
Auto-Car Equipment Co.	4,500	10,000	60 hp.	4 vert.	Water	3 for. 1 rev.	130 in.	62 or 70 in.	Sliding gear	Chain	2 sets	36x5	36x7	42 in.	15 gals.
*Hewitt Motor Co.	4,500	10,000	30 hp.	4 vert.	Water	2 for. 1 rev.	138 in.	66 in.	Planetary	Chain	2	36x4 dual	36x5 dual	44 in.	27 gals.
*Knox Automobile Co.	4,300	10,000	60 hp.	4 vert.	Water	3 for. 1 rev.	149 in.	67 in.	Sliding gear	Chain	4	36x5	36x4 dual	44 in.	20 gals.
*Mack Bros. Motor Car Co.	4,800	10,000	50 hp.	4 vert.	Water	3 for. 1 rev.	126 in.	68 in. front 72 in. rear	Indvl. clutch	Chain	4	36x5	36x3½ dual	.....	22 gals.
*Mack Bros. Motor Car Co. (Dumping Truck)	6,000	10,000	50 hp.	4 vert.	Water	3 for. 1 rev.	126 in.	68 in. front 72 in. rear	Indvl. clutch	Chain	4	36x6	36x4 dual	.....	22 gals.
Ralph L. Morgan	....	10,000	45 hp.	4 vert.	Water	2 for. 1 rev.	108 in.	60 in.	Planetary	Chain	3	36x5	36x4 dual	.....	25 gals.

*List price is for chassis only.

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Manufacturers of Gasoline Motor Cabs.

Name of Maker—	Price. List	Passenger Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	No. of Brakes.	Size of Front Tires.	Size of Rear Tires.	Type of Clutch.	Extreme Length Over All.	Fuel Tank Capacity.
American Locomotive Co.	$3,350	5	16 hp.	4 vert.	Water	3 for. 1 rev.	103 in.	56 in.	Sliding gear	Shaft	2 sets	32x4	32x4	Disc	144 in.	12 gals.
Apperson Bros. Auto. Co.	3,000	5	30 hp.	4 vert.	Water	3 for. 1 rev.	119 in.	56 in.	Sliding gear	Shaft	2 sets	34x4	34x4	Contract'g	166 in.	15 gals.
Atlas Motor Car Co.	2,500	5	22 hp.	2 vert.	Water	3 for. 1 rev.	100 in.	56 in.	Sliding gear	Shaft	3	30x4	30x4	Disc	144 in.	18 gals.
Cleveland Taxicab Co.	....	4	20 hp.	4 vert.	Water	3 for. 1 rev.	106 in.	54 in.	Sliding gear	Shaft	3	32x4	32x4	Disc	156 in.	15 gals.
Elmore Mfg. Co.	2,250	4	24 hp.	3 vert.	Water	3 for. 1 rev.	104 in.	56 in.	Sliding gear	Shaft	4	34x4	34x4	Exp'and'g	147 in.	15 gals.
Ford Motor Co.	950	5	20 hp.	4 vert.	Water	2 for 1 rev.	100 in.	56 in.	Planetary	Shaft	3	30x3½	30x3½	Disc	140 in.	10 gals.
Knox Automobile Co.	3,000	5	30 hp.	4 vert.	Air	3 for. 1 rev.	102 in.	56 in.	Sliding gear	Shaft	3	32x4	32x4	Cone	126 in.	16 gals.
Knox Automobile Co.	3,250	5	38 hp.	4 vert.	Water	3 for. 1 rev.	102 in.	56 in.	Sliding gear	Shaft	3	32x4	32x4	Cone	134 in.	16 gals.
Sultan Motor Co.	....															
Thomas Motor Car Co.	3,000	6	20 hp.	4 vert.	Water	3 for. 1 rev.	103 in.	56 in.	Sliding gear	Shaft	2 sets	32x4	32x4	Disc	150 in.	12 gals.

Manufacturers of Gasoline Motor Buses.

Name of Maker—	Price. List	Passenger Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	No. of Brakes.	Size of Front Tires.	Size of Rear Tires.	Type of Clutch.
American Machine Mfg. Co.	$3,500	30	35 hp.	4 vert.	Water	3 for. 1 rev.	111 in.	56 in.	Sliding gear	Chain	2	34x4	36x5	.....
American Motor Truck Co.	2,750	14	40 hp.	4 vert.	Water	3 for. 1 rev.	112 in.	56½-61 in.	Sliding gear	Chain	2	36x3½	36x4	Cone
*Autocar Company	2,000	12	18 hp.	2 horiz.	Water	3 for. 1 rev.	85-97 in.	56 in.	Sliding gear	Shaft	3	32x3½	32x3½	Floating ring
Auto-Car Equipment Co.	3,500	14	40 hp.	4 vert.	Water	4 for. 1 rev.	120 in.	62 in.	Sliding gear	Chain	4 sets	36x3½	36x4	Cone
*Carlson Motor Truck Co.	3,000	16	24 hp.	4 horiz.	Water	3 for. 1 rev.	108 in.	64 in.	Planetary	Chain	4	.....	.....	Disc
*Chase Motor Truck Co.	900	8	15 hp.	3 vert.	Air	2 for. 1 rev.	90 in.	56 in.	Planetary	Chain	2	38x1⅝	38x1⅝	Disc
Commercial Motor Truck Co.	2,600	16	40 hp.	4 vert.	Water	.....	128 in.	56 in.	Friction	Chain	2	34x3	36x4	.....
Coppock Motor Car Co.	4,000	12	30 hp.	3 vert.	Water	3 for. 1 rev.	126 in.	58 in.	Sliding gear	Chain	4	32x3½	32x3 dual	Cone
Grabowsky Power Wagon Co.	2,600	12	35 hp.	4 horiz.	Water	2 for. 1 rev.	102 in.	56 in.	Planetary	Chain	3	32x3½	32x3½	Cone
Grabowsky Power Wagon Co.	2,750	16	35 hp.	4 horiz.	Water	2 for. 1 rev.	102 in.	56 in.	Planetary	Chain	3	32x3½	32x3½	Cone
Grabowsky Power Wagon Co.	3,050	20	35 hp.	4 horiz.	Water	2 for. 1 rev.	127 in.	56 in.	Planetary	Chain	3	32x4	34x4	Cone
Grabowsky Power Wagon Co.	3,750	25	35 hp.	4 horiz.	Water	2 for. 1 rev.	127 in.	56 in.	Planetary	Chain	3	32x5	34x5	Cone
Gramm Logan Motor Car Co.	3,500	30	40 hp.	4 vert.	Water	3 for. 1 rev.	120 in.	60 in.	Sliding gear	Chain	4	36x5	36x3½ dual	Disc
Gramm Logan Motor Car Co.	2,250	20	25 hp.	4 vert.	Air	3 for. 1 rev.	98 in.	56½ in.	Sliding gear	Chain	4	34x3½	34x3½	Disc
*Hewitt Motor Co.	2,750	16	24 hp.	2 horiz.	Water	2 for. 1 rev.	109 in.	60 in.	Planetary	Chain	2	34x4	34x7 dual	Cone
Oscar Lear Automobile Co.	3,300	18	24 hp.	4 vert.	Blower	4 for. 1 rev.	128 in.	66 in.	Sliding gear	Chain	3	.....	.....	Cone
J. V. Lindsley Co.	620	9	18 hp.	2 opp.	Air	2 for. 1 rev.	96 in.	56-62 in.	Planetary	Chain	2	.....	.....	.....
Mack Bros. Motor Car Co.	5,500	12	50-hp.	4 vert.	Water	3 for. 1 rev.	138 in.	66 in.	Ind. clutch	Chain	4	36x4	36x3 dual	Cone
Mack Bros. Motor Car Co.	4,800	12	50 hp.	4 vert.	Water	3 for. 1 rev.	122 in.	66 in.	Ind. clutch	Chain	4	36x4	36x3 dual	Cone
Mack Bros. Motor Car Co.	5,000	16	50 hp.	4 vert.	Water	3 for. 1 rev.	122 in.	59 in.	Ind. clutch	Chain	4	36x4½	36x3 dual	Cone
Mack Bros. Motor Car Co.	5,500	16	50 hp.	4 vert.	Water	3 for. 1 rev.	132 in.	68 in.	Ind. clutch	Chain	4	36x5	36x3½ dual	Cone
Mack Bros. Motor Car Co.	5,000	20	50 hp.	4 vert.	Water	3 for. 1 rev.	148-154 in.	68 in.	Ind. clutch	Chain	4	36x4½	36x3½ dual	Cone
Mack Bros. Motor Car Co.	6,500	22	50 hp.	4 vert.	Water	3 for. 1 rev.	162 in.	68 in. front 72 in. rear.	Ind. clutch	Chain	4	36x6	36x4 dual	Cone
Rapid Motor Vehicle Co.	....	12-20	24-30 hp.	2 opp.	Water	3 for. 1 rev.	100-111 in.	56 in.	Planetary	Chain	4	3½ in.	4 in.	Disc
Knox Automobile Co.	3,200	14	20 hp.	2 horiz.	Air	2 for. 1 rev.	97 in.	56 in.	Planetary	Chain	3	32x3½	32x3½	.....
Knox Automobile Co.	3,200	19	20 hp.	2 horiz.	Air	2 for. 1 rev.	100 in.	56 in. front 58 in. rear	Planetary	Chain	3	34x3½	34x4	.....

*List price is for chassis only.

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Manufacturers of Electric Wagons Rated to Carry From 350 to 2000 Lbs.

Name of Maker—	List Price.	Normal Load Capacity.	Normal Road Speed.	No. of Motors.	No. of Battery Cells.	Mileage on Single Charge.	Drive to Road Wheels.	Standard Wheel Base.	Track or Gauge.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Special Features.
Baker Motor Vehicle Co.	$2,600	2,000 lbs.	11 M.P.H.	1	42	40-60	Chain	92 in.	56 in.	34x3½	34x3½	34 in.	Quick detachable battery cradle.
Champion Wagon Co.	2,500	2,000 lbs.	10½ M.P.H.	1	44	40	Chain	90 in.	58 in.	34x3½	34x3½	30 in.	
Commerc'l Motor Truck Co. of America	2,500	1,000 lbs.	15 M.P.H.	1	40	60	Spiral	90 in.	56½ in.	36x3	40x3	36 in.	
Commerc'l Motor Truck Co. of America	3,000	2,000 lbs.	12 M.P.H.	1	40	60	Spiral	100 in.	62 in.	34x3½	36x4	34 in.	
Couple Gear Freight Wheel Co.	2,400	2,000 lbs.	9 M.P.H.	2	40	40	Couple gear	82 in.	56 in.	36x3½	36x3 steel	32 in.	Front wheel drive
Couple Gear Freight Wheel Co.	2,500	2,000 lbs.	9 M.P.H.	2	40	40	Couple gear	82 in.	56 in.	36x3½	36x3½ rub.	42 in.	Front wheel drive
General Vehicle Co.	1,800	350 lbs.	14 M.P.H.	1	44	50	Chain	70 in.	50 in.	30x2	30x2	43 in.	
General Vehicle Co.	2,200	1,000 lbs.	11 M.P. H.	1	44	40	Chain	83½ in.	55 in.	32x2½	32x2½	60 in.	
General Vehicle Co.	2,650	2,000 lbs.	10 M.P.H.	1	44	40	Chain	102 in.	60 in.	32x3½	32x3½	60 in.	
Pittsburg Motor Vehicle Co.	1,800	750 lbs.	11 M.P.H.	1	22	40	Chain	75 in.	54 in.	32x2½	34x2½	35 in.	
Pittsburg Motor Vehicle Co.	2,400	1,500 lbs.	9 M.P.H.	2	42	40	Chain	96 in.	64 in.	34x3½	34x3½	38 in.	
Studebaker Automobile Co.	....	800 lbs.	11¼ M.P.H.	1	24	30	Chain	84 in.	59 in.	36x2½	42x2½	34 in.	
Studebaker Automobile Co.	....	1,500 lbs.	11 M.P.H.	2	44	35	Chain	91 in.	56 in.	36x3	42x3	36 in.	
Waverley Co.	1,500	800 lbs.	14 M.P.H.	1	40	40	Gear	85 in.	54 in.	30x4	30x4	31 in.	
Waverley Co.	1,800	1,200 lbs.	12 M.P.H.	1	42	35	Chain	91 in.	60 in.	32x3	36x3	36 in.	
Waverley Co.	2,250	2,000 lbs.	9 M.P.H.	2	42	30	Chain	92 in.	67 in.	36x3	36x3	40 in.	
Lansden Co.	2,450	1,000 lbs.	12 M.P.H.	1	60	45	Chain	88 in.	56 in.	32x2½	32x2½	31 in.	
Lansden Co.	2,450	2,000 lbs.	10 M.P.H.	1	60	35	Chain	88 in.	56 in.	32x3	32x3	31 in.	
Lansden Co.	3,050	2,000 lbs.	10 M.P.H.	1	60	50	Chain	88 in.	56 in.	32x3	32x3	31 in.	

Manufacturers of Electric Wagons Rated to Carry From 2,500 to 4,000 Lbs.

Name of Maker—	List Price.	Normal Load Capacity.	Normal Road Speed.	No. of Motors.	No. of Battery Cells.	Mileage on Single Charge.	Drive to Road Wheels.	Standard Wheel Base.	Track or Gauge.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Special Features.
Commercial Truck Co. of America	$3,500	4,000 lbs.	10 M.P.H.	2	42	40	Spur gear	.....	.....	.....	.....	40 in.	
Couple Gear Freight Wheel Co.	3,075	4,000 lbs.	8 M.P.H.	2	42	35	Couple gear	96 in.	56 in.	36x5	36x3½ steel	42 in.	Front wheel drive
Couple Gear Freight Wheel Co.	3,200	4,000 lbs.	7½ M.P.H.	2	42	35	Couple gear	96 in.	56 in.	36x5	36x5 rub.	42 in.	Front wheel drive
Couple Gear Freight Wheel Co.	3,800	4,000 lbs.	10 M.P.H.	4	44	35	Couple gear	96 in.	56 in.	36x5	36x5 rub.	42 in.	Four wheel drive
General Vehicle Co.	3,400	4,000 lbs.	8½ M.P.H.	1	44	40	Chain	111½ in.	61 in.	36x4	36x2½ d'l	42 in.	
Lansden Company	3,600	4,000 lbs.	8 M.P.H.	1	60	35	Chain	100-112 in.	66 in.	32x4	32x4	35 in.	
Pittsburg Motor Vehicle Co.	2,900	3,000 lbs.	8 M.P.H.	2	42	35	Chain	108 in.	64 in.	34x4	34x4	37 in.	
Studebaker Automobile Co.	....	2,500 lbs.	9½ M.P.H.	2	44	35	Chain	104 in.	58½ in.	36x4	42x4	38 in.	
Studebaker Automobile Co.	....	4,000 lbs.	9¼ M.P.H.	2	44	35	Chain	117 in.	61 in.	36x5	36x3½ d'l	38 in.	
Waverley Company	3,250	4,000 lbs.	8 M.P.H.	2	42	25	Chain	111 in.	73 in.	36x4	36x4	42 in.	

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Manufacturers of Electric Wagons Rated to Carry From 4500 to 8000 Lbs.

Name of Maker—	List Price.	Normal Load Capacity.	Normal Road Speed.	No. of Motors.	No. of Battery Cells.	Mileage on Single Charge.	Drive to Road Wheels.	Standard Wheel Base.	Track or Gauge.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Special Features.
Auto-Car Equipment Co.	$3,500	6,000 lbs.	10 M.P.H.	2	42	40	Chain	95 in.	60 in.	36x4	36x5 dual	42 in.	
Commercial Truck Co. of America	4,000	7,000 lbs.	9 M.P.H.	4	42	30	Spur gear	114 in.	76½ in.	36x3½ d'l	36x3½ d'l	41 in.	Four wheel drive
Couple-Gear Freight-Wheel Co.	4,400	7,000 lbs.	10 M.P.H.	4	44	35	Couple gear	102 in.	66 in.	36x3½ d'l	36x3½ d'l	42 in.	Four wheel drive
General Vehicle Co.	4,000	7,000 lbs.	7 M.P.H.	1	44	35	Chain	125 in.	65 in.	36x6	36x3½ d'l	40½ in.	
Pittsburg Motor Vehicle Co.	3,400	6,000 lbs.	7 M.P.H.	2	42	35	Chain	120 in.	64 in.	34x5	34x5	36 in.	
Studebaker Automobile Co.	....	7,000 lbs.	9 M.P.H.	2	44	30	Chain	127 in.	75 in.	36x5	36x4 dual	40 in.	
Waverley Company	3,750	6,000 lbs.	7 M.P.H.	2	42	25	Chain	118 in.	73 in.	36x5	36x5	43 in.	

Manufacturers of Electric Wagons Rated to Carry 10,000 Lbs. and Over.

Name of Maker—	List Price.	Normal Load Capacity.	Normal Road Speed.	No. of Motors.	No. of Battery Cells.	Mileage on Single Charge.	Drive to Road Wheels.	Standard Wheel Base.	Track or Gauge.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Special Features.
Auto-Car Equipment Co.	$4,500	12,000 lbs.	6 M.P.H.	2	42	35	Chain	100 in.	72 in.	36x6	36x7	48 in.	
Commercial Truck Co. of America	4,500	10,000 lbs.	5½ M.P.H.	4	42	25	Spur gear	132 in.	79½ in.	36x4 dual	36x4 dual	41 in.	Four wheel drive
Couple Gear Freight Wheel Co.	5,000	10,000 lbs.	5 M.P.H.	4	44	25	Couple gear	102 in.	72 in.	36x4 dual	36x4 dual	42 in.	Four wheel drive
General Vehicle Co.	4,500	10,000 lbs.	6 M.P.H.	1	44	30	Chain	142 in.	66½ in.	36x7	36x4 dual	41½ in.	
Studebaker Automobile Co.	....	10,000 lbs.	6¼ M.P.H.	2	44	..	Chain	126 in.	75 in.	36x7	36x4 dual	42 in.	

Manufacturers of Electric Buses.

Name of Maker—	List Price.	Passenger Capacity.	Normal Road Speed.	No. of Motors.	No. of Battery Cells.	Mileage on Single Charge.	Drive to Road Wheels.	Standard Wheel Base.	Track or Gauge.	Size of Front Tires.	Size of Rear Tires.	Extreme Length Over All.
Auto-Car Equipment Co.	$3,500	14	15 M.P.H.	2	42	40	Chain	100 in.	62 in.	36x3½	36x4	154 in.
Baker Motor Vehicle Co.	3,000	12	12 M.P.H.	1	42	40-60	Chain	92 in.	56 in.	34x3½	34x3½	136 in.
Com'l Truck Co. of Am.	5,500	34	12 M.P.H.	4	42	30	Spur g'r	144 in.	.....	36x4 dual	36x4 dual	252 in.
Pittsb'g Motor Vehicle Co.	2,400	12	12 M.P.H.	2	42	35	Chain	96 in.	64 in.	34x3½	34x3½	140 in.
Pittsb'g Motor Vehicle Co.	2,900	25	10 M.P.H.	2	42	35	Chain	108 in.	64 in.	36x4	36x4	154 in.
Waverley Company	3,250	10	12 M.P.H.	1	42	35	Chain	91 in.	60 in.	32x3	36x3	128 in.

Manufacturers of Gasoline-Electric Trucks Rated to Carry from 4,000 to 10,000 Lbs.

Name of Maker—	List Price.	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Motors.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
Couple Gear Freight Wheel Co.	$3,375	4,000 lbs.	25 hp.	4 vert.	Water.	2	8	96 in.	56 in.	Couple gear	2	5 in.	3½ in. steel	42 in.	10 gals.
Couple Gear Freight Wheel Co.	3,500	4,000	25 hp.	4 vert.	Water	2	8	96 in.	56 in.	Couple gear	2	5 in.	5 in. rub.	42 in.	10 gals.
Couple Gear Freight Wheel Co.	4,100	4,000	25 hp.	4 vert.	Water	4	8	96 in.	56 in.	Couple gear	4	5 in.	5 in. rub.	42 in.	10 gals.
Couple Gear Freight Wheel Co.	4,800	7,000	35 hp.	4 vert.	Water	4	8	102 in.	66 in.	Couple gear	4	7 in.	7 in. rub.	42 in.	10 gals.
Couple Gear Freight Wheel Co.	5,500	10,000	45 hp.	4 vert.	Water	4	8	102 in.	72 in.	Couple gear	4	8 in.	8 in. rub.	42 in.	15 gals.

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Industrial Machines on Exhibition

Review of the "commercial vehicle section" at the first automobile show in New York.

ALTHOUGH the management of the automobile exhibition now in progress at the Grand Central Palace in New York has done all in its power to emphasize the importance of the industrial machine, grouping the products on view and acting with rare liberality in the assignment of space, yet on the whole it is a disappointing spectacle the trained observer is called upon to witness. The representation is small and limited in character. It gives one the impression that commercial motor vehicle manufacture is in such a feeble and unformed condition as to require the sheltering support of a larger industrial development. It is a belittlement of a splendid and well established commercial purpose.

The failure of the Commercial Motor Vehicle Manufacturers' Association to hold a show of its own has resulted in scattering business machines among the three big automobile functions to which such products are eligible. If the membership of the association had been recruited as fast as was anticipated this would not have occurred. Amendments to the constitution and by-laws will probably remedy this condition before another show season arrives. Meanwhile, upon public occasions like the one under consideration, the industry must appear to great disadvantage, "licensed" products being displayed at the A. L. A. M. show, "unlicensed" products at the A. M. C. M. A. exhibition, and both, as far as limited space will permit, at the N. A. A. M. function.

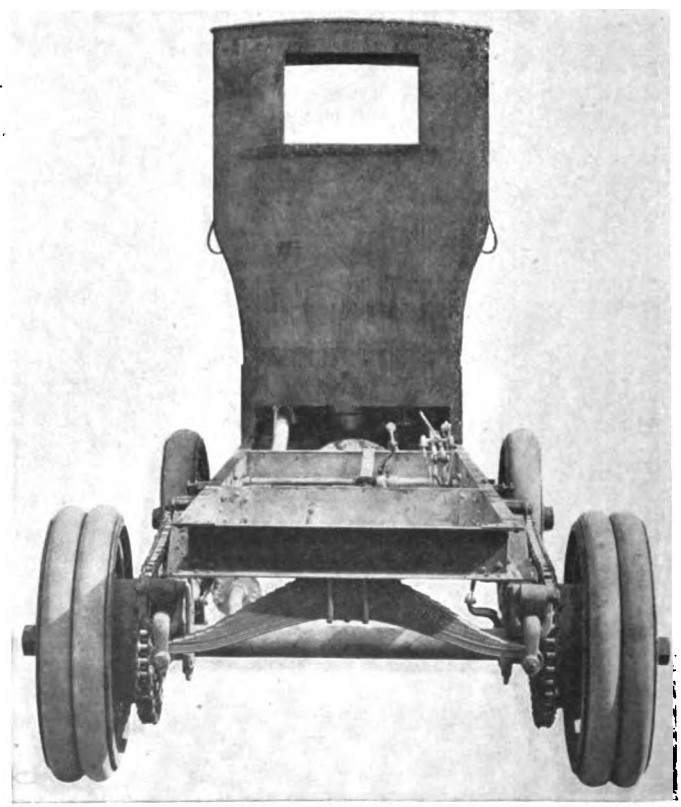
The hardship of such an arrangement is but too evident. The public is only permitted microscopic views of a rapidly expanding industry. The exhibits are necessarily meager, incomplete, and unrepresentative both of the extent and character of factory production. To make matters worse, room is at a premium in pleasure automobile shows. As a rule there is not enough space for all who make application. Rental values are high, and of the attendance only a small proportion shows interest in the commercial machine. Better one large and representative show of business vehicles, even though the attendance was numerically light, than three deceptive and costly exhibitions which are of no credit to the industry.

In themselves the industrial vehicle exhibits at the Palace show are of much importance. There is enough novelty to interest the student and enough mass to satisfy the casual visitor. The shortenings of the exhibition are hardly noticed by the latter, though this fortunate circumstance can hardly be considered as contributing to his education. Probably no other show to be held this year will equal the one now in progress for magnitude and catholicity of business vehicle display. The two succeeding shows will be even less representative than this one. Each will have its special features, but wagon exhibitors will be less numerous.

Following is a brief review of the stands:

The Rapid Motor Vehicle Co., Pontiac, Mich.

This firm manufactures gasoline wagons in ratings from one to five tons and motor buses of all varieties. The light machines are fitted with 24 and 30 hp. motors of the double opposed type. The five-ton truck is fitted with a 60 hp., four cylinder vertical motor. Some of the principal specifications of the light models, as well as of the buses, will be found in the classification tables presented elsewhere in this number. The five ton model, which is the latest addition to the firm's line, has attracted a great deal of interest. It has the strength and the engine power to transport all its platform will carry. The total length of the chassis of the standard model is 18 feet 3 inches. The wheel base is 160 inches. The tread is 66 inches in front and 76 inches in the rear. The cylinders are cast in pairs. The heads are made integral with the cylinders, as are also the valve chambers. The connecting rod and piston, being of extra length, give a low angular pressure on the cylinder walls. Inlet and exhaust valves are located on the left side of the motor. The valve heads are electrically welded to stems of large diameter. The crank shaft is of hammer-forged nickel steel, cut from a solid billet. The cams are of such design as to impart a uniform accelerated motion to the cam followers, thus giving these parts less shock and practically eliminating noise. The construction also secures a greater length of valve opening. Lubrication is accomplished by force feed oiler. The circulating water pump is of the centrifugal type, gear driven. The circulating pipes are short. The intake pipe is curved to allow the greatest freedom for the incoming gas. It can be taken off without disturbing the exhaust pipe. The exhaust pipe is unusually large, and the branches are shaped to allow the greatest freedom for outgoing gases. It can be taken off without disturbing the intake pipe. The fly wheel forms part of the clutch housing. The commutator is placed between the two central cylinders. It can be readily detached if magneto ignition is required. All the possible sources of engine trouble are grouped. This means a saving of time when locating them. Throughout the truck the construction is such that parts are



Rear view of the Rapid five-ton truck.

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easily accessible and removable. The clutch is of the multiple disc type, and is inclosed in the fly wheel. The short propeller shaft is in a straight line with the crank shaft of the motor. The transmission is of the selective sliding gear type, giving three speeds forward and one reverse. The jack shaft brakes are of the contracting band type, and are lined with a non-combustible material. The pull rods are provided with an equalizer to insure an even distribution of pressure on the brakes. The front axle is of I-beam construction of large section. The rear axle is of round section. The frame is of heavy channel steel. The sub-frame supports the motor. The steering gear is of the irreversible screw type. The fore and aft rod is provided with a flexible connection which takes up all initial road shocks. The front springs are semi-elliptic, the rear full platform. The rear brakes are of internal expanding type. They are lined with non-combustible fiber.

* * *

Hart-Kraft Motor Co., York, Pa.

This concern make a light gasoline delivery wagon. It claims the distinction of having been the first to produce a power plant that is an interchangeable, self-contained unit. Motor, magneto, transmission, clutch, differential, jack shaft, intakes, carburetor, exhausts, low speed and reverse pedals and direct drive lever, are all self-contained and suspended from the body frame by five bolts at three points. The motor, which develops 14 h. p., is of the double opposed type, with offset cylinders. Water cooling is effected by the thermo-siphon system, and air cooling by the large fan blades which constitute the spokes of the fly wheel. The transmission is of the planetary type, giving two forward speeds. The clutch is of the multiple disc type. The final drive is by side chains. Brakes of external hub drum pattern are fitted to the rear wheels. Wheels are 36 inches in diameter. The frame is of armored wood. The rated capacity of this machine is 1,000 pounds.

* * *

Olds Motor Works, Lansing, Mich.

Only a light delivery wagon is now being made by this firm. The machine is rated to carry 1,800 pounds. It is fitted with a four cylinder water-cooled engine which develops 35 h. p. Its total weight is 2,950 pounds. Shaft drive is employed. The transmission is of the selective sliding gear type. The frame is made of pressed steel. There is seating capacity for two.

* * *

Auto-Car Equipment Co., Buffalo.

This house claims rank as the oldest in the commercial motor vehicle industry. It makes a 1,000 pound delivery wagon, a one ton truck and a three ton truck—all driven by gasoline motors. It also makes electric trucks and a line of gasoline and electric buses.

* * *

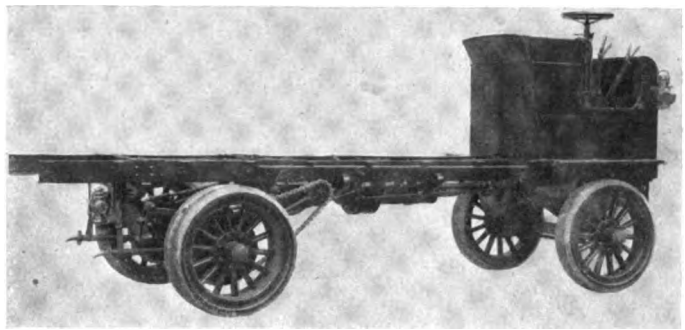
Holsman Automobile Co., Chicago.

High wheeled light wagons are the specialty of this concern. They are started from the driver's seat. The motor developing 12 h. p., is air cooled, with cylinders opposed. The spark is automatically advanced by reversing the starting handle. The weight of the vehicle is 1,055 pounds. All springs are full elliptic. The final drive is accomplished by means of ropes.

* * *

Brush Runabout Co., Detroit.

A 500 pound delivery wagon is built by this concern. Its single cylinder engine is rated at 6 h. p. It has a four inch bore and stroke and does its best work between 800 and 1,600 revolutions per minute. The trussed wood axles have been tested under the drop hammer. They are oil soaked. The corner brackets of the trussed wood frame are mortised and bolted in three directions. Spiral springs are used, located close to the axle ends. The springs operate under tension and close up on the rebound; that is, the body hangs from the under side of the springs. The top of each spring is fastened to a pin resting on



Side view of "American" truck.

The Speedwell motor truck.

Front view of the Rapid five-ton truck.

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the axle. This type of suspension gives much resilience with no possibility of breakage on the rebound. Axles are positioned by radius members pivoted on the frame with friction joints which act as shock absorbers and take care of varying road conditions. The road wheels are fitted with 32 by 2 inch solid and cushion tires and with 28 by 3 inch pneumatics. The wheel base is 74 inches and the tread 56 inches. The weight of the machine is 900 pounds. The wheel steer is on the left hand side.

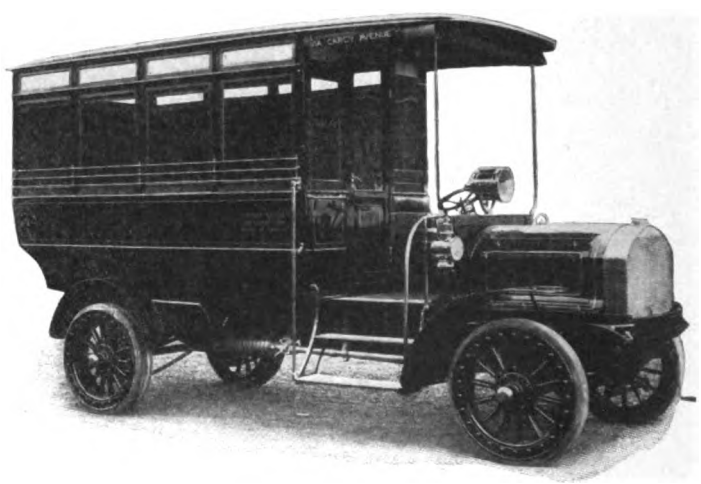
* * *

Commercial Motor Car Co., New York City.

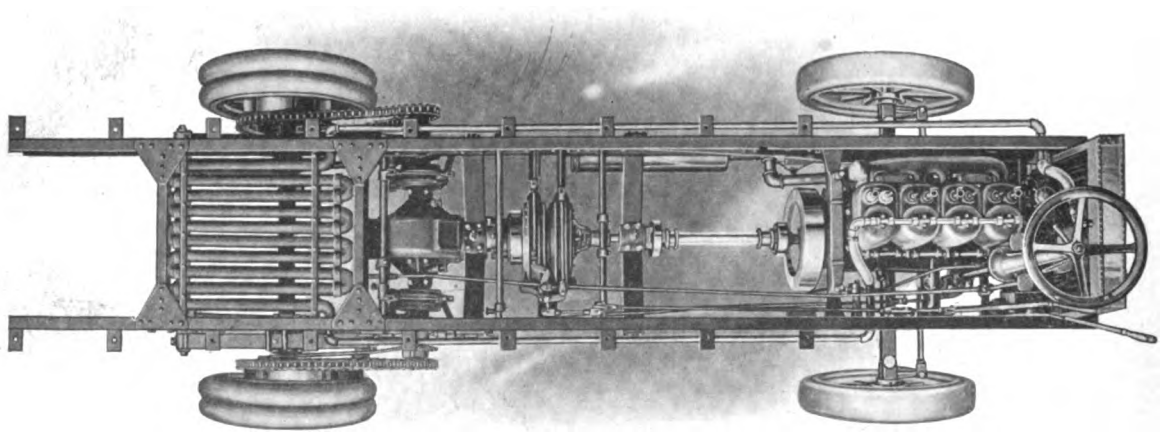
This firm is exhibiting a four ton gasoline truck built in Switzerland by Adolph Saurer and known as the Safir. All moving parts are equipped with ball bearings. The Saurer carburetor, with its astatic governor, assures economical fuel consumption and obviates sudden speed variations. The Saurer motor brake has a material influence upon the wear and tear of the tires by reason of its gradual braking effect. The Saurer self-starting appliance, enabling the motor to be stopped and started at will from the seat, has a marked effect upon the total fuel consumption as well as upon the life of the motor. The truck is equipped with a four-cylinder, four-cycle motor of approximately 30 h. p. at 1,000 revolutions per minute, and having magneto jump spark ignition.

Power is transmitted through a multiple disc clutch. The transmission is of the selective sliding gear type, having four speeds forward and reverse. The rear wheels are driven by chains and sprockets from a countershaft. Sprags to prevent the truck from running backwards down grade are secured to the rear axle in such manner that when the sprags are down the reverse gear cannot be engaged. A steel apron protects all of the power plant from below, preventing the accumulation of dust, dirt and mud on the mechanical parts. In addition to the motor brake, two additional sets of brakes are provided, one on the counter-shaft and internal expanding brakes on the rear wheels. The total length of truck equipped with standard body, 19 feet 7 inches; width, 6 feet 6 inches; wheel base, 12 feet 9 inches. The carburetor is controlled by a lever on the steering wheel. This same lever, when rotated in the opposite direction, has the function of shutting off the gasoline supply from the carburetor, opening the carburetor air passage and changing the timing of the exhaust valves of the motor with reference to the crank shaft position, thereby transforming the motor temporarily into an air compressor. In order to secure the maximum braking power, which is 75% of the motor power, the exhaust valves are opened by means of a shifting cam at the period when under the normal operating condition of the motor the explosion stroke operating would commence, and the operating cycle would follow, thus: 1, admission of air through inlet valves; 2, compression of air with

The Mack five-ton truck.



The Mack 16-passenger bus, with side entrance.



Chassis of American Motor Truck Co.'s three-ton machine.

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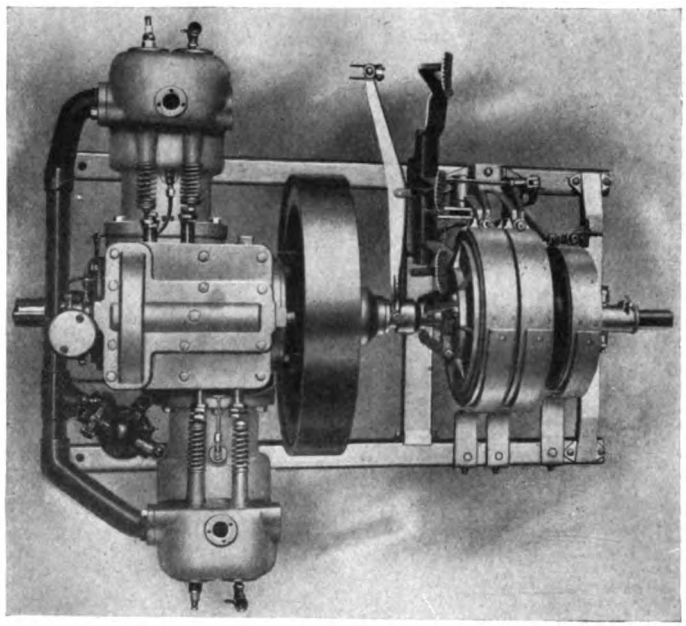
valves closed; 3, opening of exhaust valves at top dead center and exhaust of compressed air, respiration through exhaust pipe under atmospheric pressure; 4, compression of air valves closed, opening of inlet valve on top dead center and release of compressed air, followed by the same series of air admission, compression and exhaust. By gradually altering the timing of the exhaust the braking power can be varied at will. The advantages of this form of braking are self-evident, the principle being the extreme flexibility of control, cooling and cleaning of the motor with fresh air, elimination of heat and wear always present in friction brakes, and the greatly reduced tendency toward skidding and side slipping. The Saurer motor self-starter is especially valuable where traffic is congested. It consists of a water cooled air pump which may be engaged with the driving shaft of the motor through a suitable clutch, maintaining an air pressure of about 15 atmospheres in an auxiliary tank, and by means of the control lever and distributing valves starting the motor from rest on the four-cycle principle, using, however, compressed air in place of explosive mixture.

* * *

Grabowsky Power Wagon Co., Detroit, Mich.

Gasoline wagons rated to carry 1½ tons, 3 tons and 5 tons are being made by this company. The units of the lighter model are interchangeable. Other features of its design are: Like axles, both front and rear, steel wheels, pressed steel frame, double opposed engine placed transversely, a power plant which can be detached from the vehicle in a few minutes and an unobstructed frame surface which permits quick removal and replacement of the body. It is a clean bit of work. The engine has a 5¼ inch bore and a 5 inch stroke. The crank-shaft is a chrome nickel steel forging 1⅞ inches in diameter, with bearings for connecting rod 2¼ inches. Valves are of chrome nickel steel with cast iron heads. The power plant is located on a sub-frame consisting of two channel steel sections. This sub-frame also contains the transmission and operating levers. By removing two bolts and making six rapid disconnections the power plant, including transmission, can be removed intact and a new power plant installed in a very few minutes. Ignition connections are made by running all wires through a plug system which is connected and disconnected by means of a master plug. High tension jump spark ignition is employed. Transmission is of the planetary type, giving two speeds forward and a reverse. The high speed clutch is of the self-retaining cone type. The jack shaft can be quickly removed by taking off the end plates and chains, and disconnecting the radius rods. There are two internal expanding brakes in the rear wheels and an emergency drum brake on the engine shaft. The internal brakes are actuated by a steel wedge operating between two rollers. Adjustment is obtained by raising the wedge. Although steel wheels form the regular equipment of the machine the manufacturers are prepared to supply wood wheels whenever



Power plant of the Grabowsky 3,000-pound wagon.

customers specify them. Both axles are of the same material and dimensions, namely, 1½ inches by 2¾ inches.

* * *

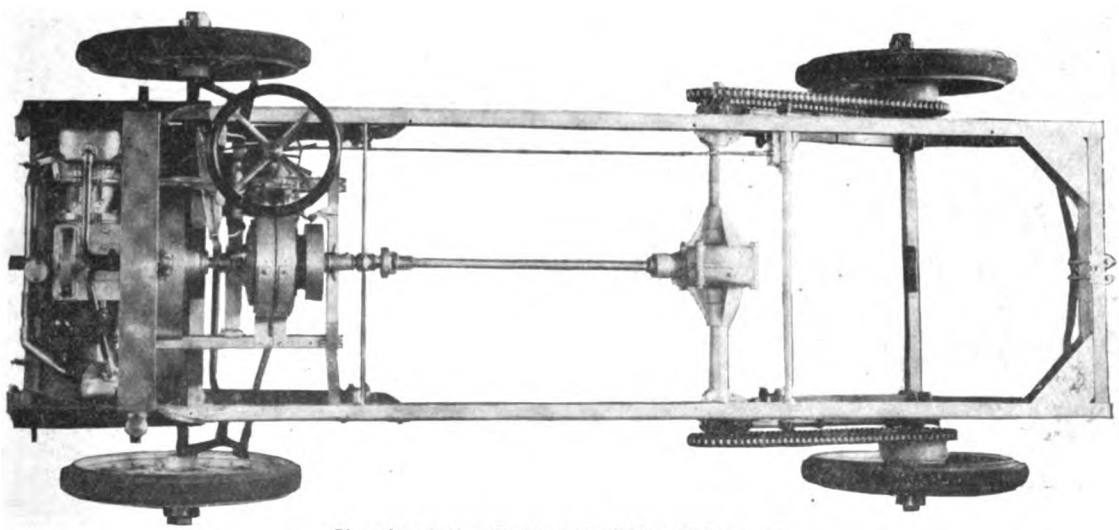
Gramm-Logan Motor Car Co., Bowling Green, Ohio.

Three models are made by this company, a light delivery wagon, fitted with air-cooled, four cylinder, 25 hp., engine, a 1½-ton truck similarly powered, and a three-ton truck equipped with a water-cooled, four-cylinder, 45 hp. engine. The engine cylinders of the heavier model are cast in pairs, and so arranged as to bring the valves, intake, etc., on the right side of the motor. This is a reversal of practice in the design of motors of this type. The cylinders are offset one inch from the crank shaft in order to reduce friction on the explosion stroke and permit smoothness and quietness of operation. The two weak points in cylinder design, the head and flange, have received special attention and are unusually strong. The gear case is cast integrally with the crank case. The clutch is of the multiple disc variety. The final drive is accomplished from jack shaft to rear wheels by side chains. The tire equipment is 36 by 5 inches in front and 36 by 3½-inch twins in the rear. The wheel base is 120 inches. The tread is 60 inches.

* * *

Speedwell Motor Car Co., Dayton, Ohio.

This firm exhibits a gasoline truck with a wheel base of 120 inches, tread of 56 inches, and fitted with 24 hp. four cylin-



Chassis of the Grabowsky 3,000-pound wagon.

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der motor, with valves on the side and single camshaft. Double ignition is provided. The transmission is of the selective sliding gear type, with three forward speeds. Gears are cut from Vanadium steel. The front axle is hydraulically forged, of I-beam section, with roller bearings; the rear axle is of the floating type. The tire measurements are 34x5 inches all around.

* * *

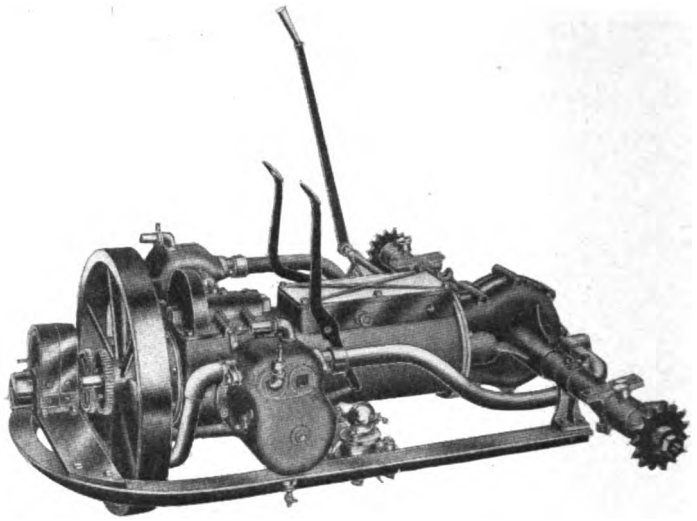
Pittsburg Motor Vehicle Company, Pittsburg, Pa.

This firm, making electric vehicles, exhibits a 750 pound model and another rated to carry 1,500 pounds. Both have a permissible overload of 33 1-3 per cent. The light machine has a speed of 10 miles an hour and a radius of between 35 and 40 miles on a single battery charge. The speed of the heavier model is 9 miles an hour and the radius in service is about 40 miles. The principal feature of the light model is the direct drive from motor to rear axle by means of chain without countershaft to intermediate gears. Other noticeable features of its construction are the small 22 cells, 11 plate battery, and the extremely light weight of the whole machine, which only amounts to 2,500 pounds. The heavier model has no left or right hand parts, and nothing but U. S. standard threads throughout. The wheels are interchangeable all around. Two motors are used in driving the rear wheels individually. In this model Morse chain reduction from each motor to corresponding countershaft is also visible.

* * *

American Motor Truck Co., Lockport, N. Y.

This firm manufactures one and three ton trucks and buses. The three-ton machine is equipped with a 40 hp., slow speed, four cylinder engine. The cylinders are offset. The dimensions of the front axle are 2½ by 4 inches. The rear axle is 2½ inches square. The frame is of armored wood. The construction throughout is of an exceedingly high order. Practically the whole machine is made in the company's factory. The frame of the one-ton truck is also chiefly composed of wood, the corners being braced with angle iron and bound with armor plate. Its front axle is of I-beam section; the rear is square. The light machine is driven by a four-cylinder engine developing 22—25 hp. All products of the factory are guaranteed for a year from date of shipment. It is scarcely necessary to say that this guarantee only covers normal service and defects which may happen to exist in material and workmanship. More extensive information of the characteristics of the models are to be found in the tables of manufacture printed elsewhere in this issue.

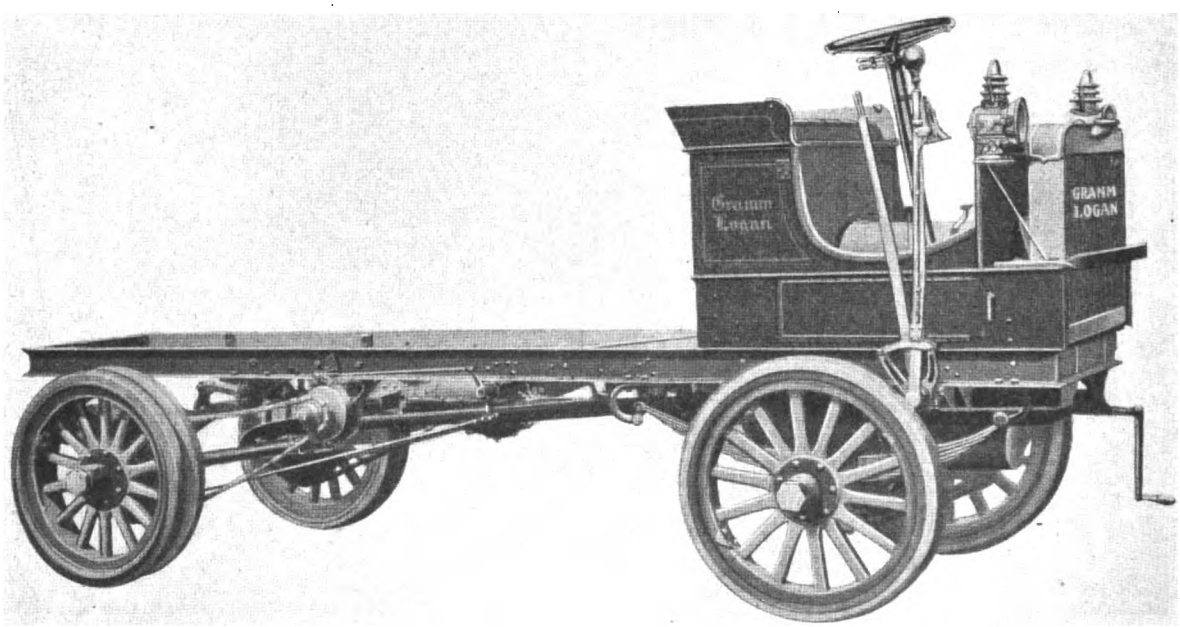


Hart-Kraft Self Contained Power Plant Unit.

Mack Bros. Motor Car Co., Allentown, Pa.

Heavy trucks and buses are the principal products of this company. The five-ton truck has a range of 80 miles on good roads with a single filling of the gasoline tank. The axles measure 2½ inches in front and 2¾ inches in the rear. The weight of the chassis is 7,200 pounds. The normal road speed is eight miles per hour. At this rate of travel the engine speed is 800 r. p. m. The engine, of the four cylinder vertical type, with 5½ inch bore and 6 inch stroke, is powerful enough to negotiate a grade of 20 per cent. on the low gear and a 6 per cent. grade on the high gear. The firm's 16 passenger bus has entrance on the right hand side, in front, near the driver. The machine is provided with electric push buttons and acetylene lights. The interior may be heated by the exhaust from the motor, a three-way cock being used to throw heat off and on as desired. The normal rate of speed of this bus is 12 miles per hour, the engine speed at this rate of travel being 800 r. p. m.

A dairy farmer in the neighborhood of Norfolk, Va., employs a motor wagon in transporting milk supplies to market.



The Gramm-Logan three-ton truck.

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Product of Eight Years of Experiment.

Ralph L. Morgan constructs a five ton gasoline truck which has extremely light prime weight.

WHEN a talented automobile engineer devotes eight of his most useful years to the creation of a motor truck it is reasonable to expect that the finished product will exhibit many unusual features of design. The five ton gasoline machine built by Ralph L. Morgan, of Worcester, Mass., is the result of this long period of gestation. It does more than reveal the genius of its author. It establishes a new mark in engineering refinement, which is all the more gratifying since it is calculated to benefit that form of mechanical road transport which is most neglected, namely, the haulage of very large loads.

* * *

The chassis of the Morgan truck only weighs 6,000 pounds. It will sustain a 40 per cent overload. These statements furnish proof of the care which has been bestowed upon the design. Excessive prime weight is a blemish which is too frequently found in many gasoline trucks of five ton rating. Dead weight should be kept as low as possible in order that the motive power shall prove ample in transporting the paying load. Speaking of this matter Mr. Morgan says:

"The A. L. A. M. formula for computing horsepower adopted is $\frac{D^2 \times N}{2.5}$ and based on a thousand feet piston speed per minute. A good four cylinder motor with 5 inch bore will develop at least 40 hp. as five inches equal D, which, being squared and multiplied by the number of cylinders, 4, (N) and divided by the constant 2.5, will give 40 hp. as a conservative rating for that size motor. My engine, with its 5 × 4¾ inch pistons, can, if necessary, register up to 50 hp., giving a reserve of 10 hp. It is seldom necessary, however, to call on this reserve, but it is there when wanted. Computing with round figures, it will readily be seen that the engine on this truck will register one horsepower for each 340 pounds. This unusual capacity in a measure explains why the truck, under the most distressing road conditions, pulls heavy loads without effort or undue strain on engine. It also explains why it stands up so nobly under punishment. The engine is extremely light. It weighs from 100 to 200 pounds less than most other 40 hp. automobile motors."

* * *

The countershaft of the Morgan truck is one of its most interesting features. It can be locked at will. The compensating gear is made idle by inserting a one inch pin in the Vernier lock which is outside one of the minor sprockets. The locking is instantaneous. The countershaft is mounted on spherical bearings attached to the side frame members and, owing to its construction, the twisting of the vehicle frame from time to time in no way affects the alignment of machinery. The advantage of this lock-countershaft construction is paramount when one wheel of the truck slides into a mud hole, because the moment the locking is effected both wheels get equal traction. Consequently the truck needs no assistance when mud holes are encountered.

The total length of the Morgan truck is 14 feet; width, 6 feet; wheel base, 108 inches; gauge, 60 inches; gasoline capacity, 25 gallons; car is driven through double chain; rear axle is solid; clearance under front axle, 14 inches; clearance under rear axle, 16 inches; speed change gear, planetary or epicyclic; two speeds forward, one reverse, operated by single lever at right of seat; throttle controlled by lateral slide foot lever; speed under maximum load, 10 to 12 miles per hour.

* * *

The engine is of the four-cylinder, vertical type, cylinders cast in blocks of two, with water jackets integral; clutch, multiple disc; valves, flat type, made of nickel steel; crankshaft and countershaft, nickel steel; engine is enclosed in unit aluminum shell, with oil pan at bottom; inlet and exhaust operated by single cam shaft.

The steering gear is of the pinion and sector order. Internal expanding brakes are fitted to the rear wheels, the diameter of the drums being 18 inches, with 4-inch face. The frame is made of 6-inch channel steel. The front axle is of 4-inch I-beam pattern. The rear axle is 3¼ inches round. Wheels are made of pressed steel. The standard gearing is 9 to 1 on high and 27 to 1 on low and reverse. These ratios can be changed to suit varying service conditions.

Starting is automatically accomplished by means of magneto ignition. The starting device in its action retards the first spark produced when the engine is being cranked, always firing a charge after dead center has been passed. When the first spark has been produced the magneto instantly assumes normal position, and is then ready for regular running. By the use of this magneto it is possible to start the engine of the Morgan truck with a half turn of crank, turning the latter as slowly as may be desired. The time saved in the aggregate through quick starting justifies the fitting of this expensive imported magneto.

* * *

Evidences of the economy of the Morgan truck are not lacking. In five days of the month of November it hauled 333,226 pounds of steel and wire. Combining the retail cost of the oil with that of the gasoline consumed in doing this work, the fuel expense totaled $3.47. This figures out at 2 cents per ton for load carried, or 5 mills per ton mile. This is, of course, exclusive of driver's wages, etc. The distance traveled was 125 miles, or an average of 25 miles per day. It is quite evident that a larger tonnage and greater mileage could have been recorded if the machine had been more actively worked. Under normal operating conditions, running 40 miles a day, the daily cost of maintaining this machine is about $8,36. In this sum all charges, including depreciation at 20 per cent per annum, are included. An allowance of $2.50 per day is made for

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driver's wages. Other items in the cost of daily service are as follows: Tires, $1.33; gasoline, 65 cents; interest at 5 per cent, 56 cents; insurance at 2 per cent, 25 cents; repairs, $1.

Hauling 20 tons per day, the average total cost would amount to 4.18 cents per ton mile. On long hauls, with full loads, this figure could probably be lessened. The item of one dollar for repairs is generous.

Many years ago Mr. Morgan built steam trucks. They were good enough at the time to earn a gold medal in the first industrial motor vehicle competition held in this country. Having no faith in the future of heavy steam-driven machines, however, he abandoned that branch of engineering. Soon thereafter he became famous for his ability as a gasoline engine designer. The best of his work in this field is embodied in the machine just described. Mr. Morgan also enjoys celebrity as the designer of the automobile which won the New York to Paris race, an event which excited the interest of the whole civilized world.

IMPROVED CABS FOR NEW YORK.

ALL the new cabs commissioned by the New York Transportation Company are built to carry four passengers without the slightest degree of inconvenience. In this respect they differ radically from the majority of small public service motor vehicles, in which only two passengers may be seated with comfort. The operation of seating more than two in the average New York cab is facetiously alluded to as "insertion". In the new cabs there is 20 inches of space between the seats.

The interior finish, too, is greatly improved. Cleanliness of service being recognized as necessary, the upholstery and fittings are not of such material or design as to harbor filth of any kind. Cloth has been discarded for seat cushions. Even the cloth top-lining has been abandoned. Hardwood and metal has taken its place. The new cabs are upholstered in leather. All seats are removable, so that the entire interior of the cab can be thoroughly washed and cleaned. Other good features are as follows: provision for trunks and hand luggage, and the location of the driver on the left-hand side, where he is better able to watch other vehicles.

The taximeters on the new cabs are driven by the front wheel, not by the rear one. It is only necessary to see the rear wheels of a cab spinning idly on slippery asphalt to appreciate the importance of this little detail to the hirer of a motor cab. Rear wheel driving of taximeters is prohibited in some cities, but it is still allowed in New York.

The board of public safety in Indianapolis has authorized the purchase of a motor truck for the electrical division of the local fire department.

In the construction of its railways in East Africa the German government makes extensive use of motor trucks. The machines haul rails, cross ties, ballasting material and telegraph poles. Each machine pulls a trailer.

THE COST OF MOTOR MAIL WAGON SERVICE.

GOOD reasons are at hand for believing that the time is fast approaching when motor wagons, both light and heavy, will be conspicuous features of postal service equipment everywhere throughout the country. This opinion is strengthened upon reading recent official utterances upon the subject. The first assistant postmaster general thus reviews the experimental work of motor mail collecting and distributing wagons:

"The past year's experience in the use of motor vehicles for the collection of mail has served to strengthen the conviction that the introduction of these vehicles in the postal service is desirable. Funds were not available except for preliminary experiments, but studies have been made of conditions at various offices, and of the several types of machines on the market, with a view to more thorough tests in the future. As a result of the increased attention now being devoted by manufacturers to the construction of cars for commercial uses, it is believed that satisfactory types for postal purposes will be soon developed. To enable the department to conduct further experiments along the lines indicated, it is recommended that a liberal increase be made in the appropriation available for the purpose."

Milwaukee and Detroit are the only two cities in the country in which motor wagons operate between minor and main postoffices. Of the economy of these services the second assistant postmaster general says:

"Beginning July 1, 1907, an extension of automobile service under contract was inaugurated in Detroit and Milwaukee. In Detroit it covers service between the general postoffice and Stations A, B, C, D, E and F. The contract price for the service is $11,700, a rate of 19 cents per mile of travel. In Milwaukee it covers service between the general postoffice and Stations A, B, C, D and E. The contract price is $8,000, a rate of 21 cents per mile of travel. The average cost per mile of travel for regulation screen or other wagon service is 28.51 cents. The operation of the automobile service in these two cities appears to justify the opinion that where the character and condition of the streets are suitable such service may be maintained economically and operated with as great efficiency as horse wagon service, and with greater expedition."

Congress could profitably appropriate $100,000 to further establish the economy of the motor mail wagon, especially since mail contractors do not evince much eagerness to get rid of the archaic forms of transportation which the government so reluctantly accepts. Though the government may not be willing to engage in transportation on its own account it is impossible to dodge the fact that it is being cheated so far as the efficiency of the service it pays for is concerned. In Detroit and Milwaukee it is a matter of official record that motor wagon service is much cheaper and more efficient than horse wagon service. Why not force mail contractors in other more important cities to adopt such modern means of transportation. It would be safe and sound governmental policy to do so.

Five motor cabs have been put in service in Dallas, Tex.

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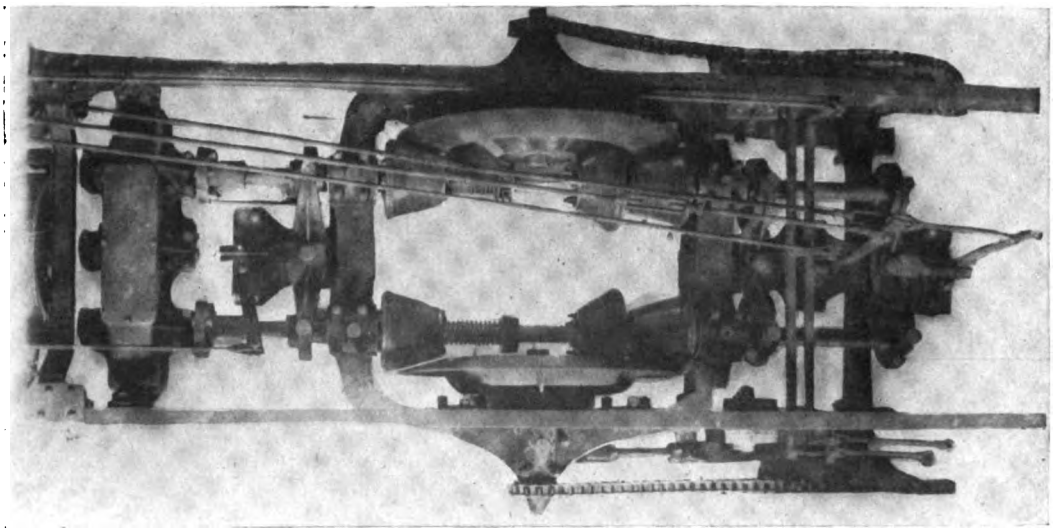


Chassis of the Parr three-ton friction driven truck.

Three Ton Friction Driven Truck.

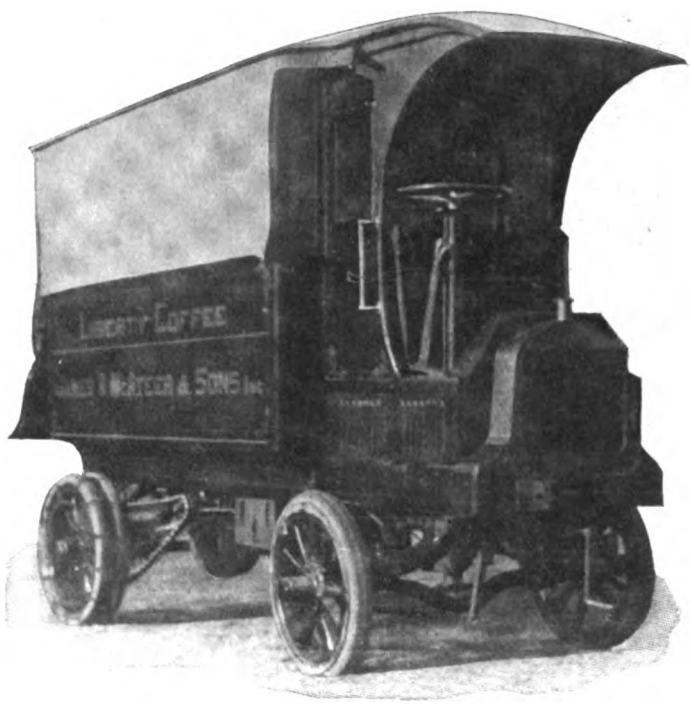
Unusual transmission design found in the machine made by the Parr Wagon Co., of Pittsburg.

ALTHOUGH quite a number of friction driven motor wagons have appeared in the market within the past few years they have all been designed for the haulage of relatively light loads. The producing firms can hardly be accused of lacking faith in the value of friction transmission for heavy duty, for they are well aware that, experimentally, the principle under consideration has been quite successfully demonstrated in such service. One, therefore, feels safe in concluding that in confining their attention to the manufacture of light load machines they have been influenced by the belief that their capital could thus be most advantageously invested. Certainly they are justified in assuming that small loads are more commonly transported than large ones. But this assumption does not necessarily deny the existence of a large market for heavy machines of the type under consideration.

* * *

Taking advantage of this condition the Parr Wagon Company, of Pittsburg, has produced a friction driven truck to carry three tons. The transmission is the principal feature of this machine. It consists of two parallel shafts running lengthwise, each shaft carrying three cones made of leather fibre. These cones come in contact with two bevel cast iron discs. Opposite direction of motion is imparted to the shafts, which are 2 inch diameter steel, by means of a set of gears constantly in mesh. The gears work in a case filled with lubricant, which only requires renewal once in three months. The parallel shafts and the discs, together with the jack shaft to which they are attached, are carried in a cast steel frame, which is bolted to the channel frame of the truck. Reference to the one of the photographs will plainly show the construction. This holds everything in a rigid position, and any variation in alignment is taken care of between the gear case and the fly wheel of the engine by a case-hardened Oldham coupling.

The forward set of cones gives reverse motion to the truck, the rear set low speed, and the inner set high speed. These cones are thrown in and out by means of an equalizing rod, which is controlled by a lever and connected by a rod to the driver's seat. The equalizing rod takes care of any unequal wear or any difference in the position of the cone on the bevels. Each cone, therefore, has its own bevel to work on. There are no gears to strip, nor shafts to bend, as in the ordinary sliding gear tranmission, and the wear takes place on the surface of the leather fibre cones, which are easily and cheaply replaced. The cones will run thousands of miles without renewal, and when it is necessary to renew them the change can be made at any time, by anyone, with the use of no other tool than a wrench. The low speed and re-



The Parr three-ton friction driven truck.

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verse cones are mounted on a collar with flanges and are slidably keyed on the shaft. They can be moved backwards and forwards. The high speed cone is fixed immovably on the shaft, so that when the high speed is thrown in the shafts carrying the high speed cones move forward and carry the high speed into contact.

The bearings carrying the cones are very large. The side thrust on the cast iron disc is taken care of by means of alternating discs of steel and bronze, 12 inch diameter, interfilled with graphite. The main bearing carrying the jack shaft is 9 inches long, giving ample wearing service.

* * *

The trap door in the floor of the truck gives ready access to the transmission and facilitates adjustment of grease cups, etc. The power plant is made accessible by removing the floor under the driver's seat, which is immediately over the motor, and also by removal of a side panel, opposite the control.

In handling the truck two levers are used. One, a foot lever, reverses and acts as a brake, and the other, a hand lever, carries high and low speeds and is so arranged that high and low cannot be thrown in at one time.

The braking surface is extremely large, the total area of the surface of the brake drums being almost six square feet. The brake bands are of the internal expanding variety.

The engine, of the four cylinder, water cooled variety, is provided with a 4¾-inch bore and 5-inch stroke. The frame, of 5-inch channel steel, is one continuous piece, strongly reinforced. Roller bearing I beam axles are used. The final drive is by side chains. The weight of the chassis is 4,300 pounds. The fuel consumption is about six miles to the gallon.

* * *

The Parr Wagon Company have been in the wagon business for about twenty years, and this machine has been designed by them for James A. McAteer & Sons, a wholesale grocery firm of Pittsburg. If the machine is able to take care of the work assigned to it an order for more is assured. Pittsburg is a city which has many radiating lines, leading to rapidly growing and populous suburbs. A great deal of money has recently been spent in improving the roads, and there are now hundreds of miles of macadam, which makes delivery to points within a radius of twenty miles comparatively easy.

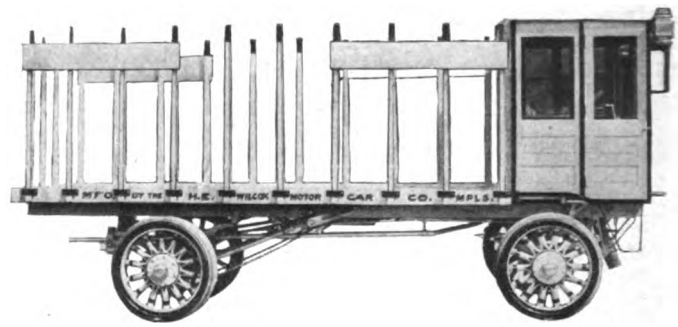
In order to expedite the delivery of thousands of Christmas gifts at the homes of poor children of Indianapolis on Christmas eve many owners of motor trucks placed machines at the disposal of the organization which had charge of the distribution. Formerly the gifts were carried in slow moving furniture vans.

Seven automobiles are now operating in the service of the postal department in Washington, D. C. Five are maintained on contract. Two are owned by mail carriers.

The fire department of Vincennes, Ind., is to be supplied with three motor hose and chemical wagons.

THE "WOLFE" GASOLINE TRUCKS.

SOME features of the gasoline trucks made by the Wilcox Motor Car Company, of Minneapolis, indicate that economy in operation has not been sacrificed in order to provide convenient engineering. The location of the engine at the side of the driver affords a longer and larger load platform area than is usual in vehicles of this class. The double method of engine starting, within and without



The "Wolfe" gasoline truck.

the driver's cab, is a refinement that will be appreciated by concerns which calculate to operate their machines with a few false delays as possible.

Three models are manufactured, for one, two and three ton loads. A four cylinder 30-hp., water cooled engine is fitted to each. The factor of safety in the whole construction is unusually high. Two ignition systems are provided in each model. The placing of the engine to one side of the driver has another value than that already noted. It makes inspection of the power plant a very simple matter, and greatly facilitates repairs and adjustments. The sliding gear transmission gives three forward speeds. The final drive is accomplished by means of side chains and jackshaft sprockets.

The wheel base of the one ton model is 117 inches. The two larger machines are provided with a 126 inch wheel base. All three models are fitted with 36 inch wheels, front and rear. The front axle of the light model is 1¾ inches. The two ton machine's front axle is 2 inches, while that of the three ton machine is 2½ inches. All are of I-beam pattern. The rear axle measurements are as follows: One ton model, 2 inches, square; two ton model, 2¼ inches, square; three ton model, 2½ inches, square. Emergency brakes are placed on the rear wheels. Service brakes are located on the shaft. The weights of the machines are as follows: One ton model, 3,800 pounds; two ton model, 4,500 pounds; three ton model, 5,500 pounds.

The motor is very economical of fuel, simple and efficient. The cylinders are offset from the crank shaft, and valves are placed on the right side, locating the carburetor, timer and magneto convenient for connections. This arrangement requires the use of three gears only, reducing gear noise to a minimum. The cylinders are cast from the best quality of reverberatory air furnace iron. The water jacket heads are removable, enabling all core sand and foreign matter to be removed and insuring more uniform wall thickness. In the event of the circulating water freezing the jacket head only is injured.

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Mitchell

MOTOR TRUCKS

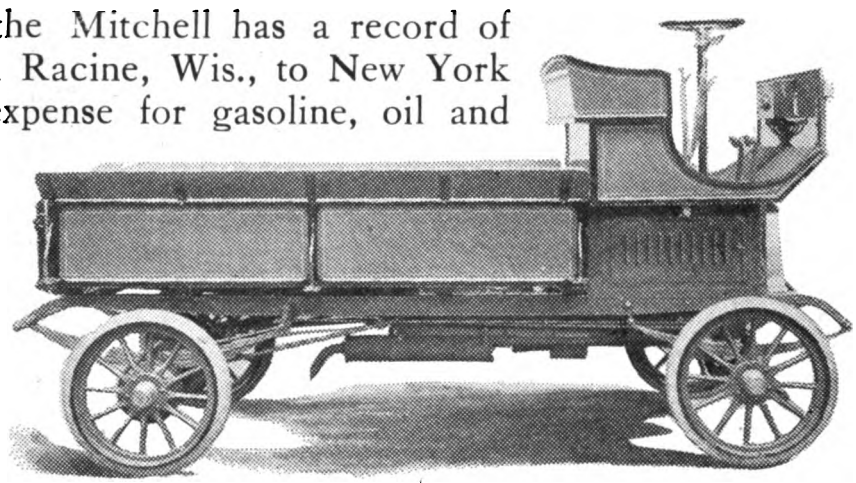
Are kept to the Standard of the Famous Mitchell Pleasure Cars

Note the Facts Before You Decide Which is the Best Truck

THE question is—Do you want the truck that has proven its value beyond any doubt on the road or the truck that bases its claims for favor on simply what it *should* do?

Remember, the Mitchell has a record of 1,169 miles from Racine, Wis., to New York for which the expense for gasoline, oil and grease amounted to but $39.40.

The average mile cost but 3⅓ cents and no truck ever traveled such roads before. Remember, too, this truck carried 50% overload as the truck is of one-ton capacity and the load was 3,400 lbs.



4 Cylinder, 20 H. P. Capacity One and One-Half Tons

Let Us Give You Details

Ask us to prove this truck best to your entire satisfaction.

Learn how it's made and why made that way.

Ask us all of your questions.

Let us answer with a wealth of evidence that will convince you at once.

NOTE THESE SPECIFICATIONS:

Wheel Base	110 inches	Engine, 4-Cylinder, Vertical	20 H. P.
Tread	56 inches	Ignition, Magneto and Dry Batteries.	
Wheels (front) Solid Tires	30x3 inches	Transmission, Sliding Gear, Three Speeds and Reverse.	
Wheels (rear) Solid Tires	30x3½ inches	Carrying Capacity	1½ tons
Body, Width (inside measurement)	3 feet, 7 inches	Axle (front) I-Beam. Axle (rear) Worm Drive.	
Body, Length (inside measurement)	8 feet	Weight of Truck, Complete	2,300 pounds
Body, Depth (inside measurement)	14 inches		

PRICE, $2,000

WRITE FOR FULL INFORMATION

The Mitchell Motor Co., 562 Mitchell St., Racine, Wis.

Standard Manufacturers A. M. C. M. A.

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MOTOR TRUCKS SUPERIOR TO RAILROADING.

RAILROAD freight traffic experts now admit the supremacy of the motor truck in hauling merchandise between Minneapolis and St. Paul. For a while they looked upon the operation of mechanical road service as in the nature of an experiment, but as their own volume of transportation between the two points began to decrease, and merchants had an opportunity to compare the rapidity and convenience of the two systems, it became plain that the road vehicle was a really formidable competitor. Now they frankly confess that rail haulage can not compete with motor road freighting.

When the only means of freight transfer between the two cities was the steam road, or horse drawn wagon, it took about two days to get a load of merchandise from one city to the other. Now a motor truck leaves the jobbing district in Minneapolis and reaches the retail district of St. Paul, or vice versa, in one hour, weather conditions proving favorable. When weather conditions are unfavorable the journey either way requires about 1½ hours for the road machines.

The whole cause for the disillusionment of the rail traffic experts, however, is not disclosed by a comparison of the running time of the two systems of haulage. Like many other people from whom a more enlightened opinion might be expected, they calculated that when severe winter weather set in the snow and ice would so militate against the operation of motor trucks that their service would become uneconomical. They confidently expected that the snow drifts would entirely stop the service of the machines. Building and roadway improvements, however, have sheltered and made the route more convenient for the passage of the machines, and the service throughout the winter goes on without interruption. Apparently it is only a question of time when the vast volume of freight passing between Minneapolis and St. Paul will be carried by motor wagons. Railroads and horses, the former with their costly delays at terminal points and many handlings of freight, and the latter with their inferior speeds and loads, are equally unable to hold their own with mechanical road haulage.

Roseburg, Ore., on the line of the Union Pacific, is to be connected by motor bus with Marshfield, a point 64 miles distant. The trip will be made in five hours. The time allowed for the horse-drawn vehicles which the machines will supersede is 18 hours.

The James Motor Express Company, of Chicago, has increased its capital stock from $10,000 to $35,000.

RADICAL CHANGES IN CAB DESIGN.

SINCE there are a good many Darracq cabs used in public service in this country it will be interesting to know something concerning the latest design of that model.

The engine has a smaller stroke and bore. The magneto is placed on the right hand side of the engine instead of on the valve side, as formerly. The magneto, which rests on an arm of the cylinder casting, can be very quickly dismounted. The water pump has been discarded. Thermo syphon cooling is employed as a substitute. Engine control is governed entirely by the accelerator pedal. Radical changes have been made in the transmission. The gear box on the rear axle, which was a distinguishing feature of the first Darracq taxicabs, has been abandoned in favor of one in the usual position, immediately behind the clutch. One of the most important of the changes in the design is the housing of the clutch spring within the forward part of the gearbox, and connecting the latter with the clutch by means of a short universally-jointed shaft. A short cross shaft is hinged at the forward end of the gearbox, and from this shaft hang two short levers, the lower ends of which bear on the face of a cylindrical housing which contains the clutch spring. A third lever stands up on the same shaft, and it is connected to the clutch pedal.

EVIL EFFECTS OF BUYING ABROAD.

ACCORDING to report the purchase of foreign motor cabs by the Knickerbocker Hotel in New York is likely to have a very serious effect upon the business of that establishment.

From the gossip that is going the rounds of the trade it appears that the hotel proprietors could not under any circumstances be induced to purchase American made machines. They balked at the delay in delivery, and affected to believe that the engineering of the domestic product was not up to the mark set by European or British designers. Now it so happens that a great many automobile tradesmen have acquired the habit of staying at the Knickerbocker when in New York, especially during the weeks of the shows. In retaliation for the affront put upon American motor cab design a movement was begun some time ago requesting that all automobile tradesmen abstain from patronizing the institution which finds nothing worthy in American products. While it remains to be seen how effective the boycott will become, there is nothing conjectural about the ill will which the Knickerbocker proprietors have incurred.

ATTRACTIVE ARRANGEMENTS CAN BE MADE FOR RENEWALS FOR "Exide" VEHICLE BATTERIES
THE GENUINE "EXIDE" PLATE HAS "EXIDE" MOULDED ON THE LUG AND IS MANUFACTURED BY
THE ELECTRIC STORAGE BATTERY CO. PHILADELPHIA
SALES OFFICES: NEW YORK BOSTON CHICAGO ST. LOUIS CLEVELAND ATLANTA SAN FRANCISCO TORONTO

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The Power Wagon

A Journal for Those Employing Commercial Motor Vehicles

No. 51 **FEBRUARY, 1909** **No. 51**

PUBLISHED THE FIRST OF EVERY MONTH BY

THE POWER WAGON PUBLISHING CO.

SUBSCRIPTION RATES:

One Year (Domestic)	$2.00
One Year (Foreign)	3.00
Single Copies	.20

PUBLICATION OFFICES:
THE METROPOLITAN BLOCK
Chicago, Illinois.

Advertising Rates on Application

WALTER WARDROP, Editor

Entered as Second-Class Matter December 2, 1907, at the Postoffice at Chicago, Ill., Under the Act of Congress on March 3, 1879.

Large Load Hauling Costs

At all distances within which horse haulage is considered profitable it is found more costly than motor haulage.

CLOSE calculation of the comparative cost of haulage by horse and motor wagon is a form of employment from which the majority of expert accountants shrink unless they are assured that the elements of each method of transportation are fixed.

Definitely to establish the superiority of the machine it is first necessary to find a service in which the expense of horse transportation is known. This is not easily done. But the quest is much sooner rewarded than the hunt for service conditions which will provide opportunity for fully comparing the effective work capacity of both horses and machines.

The horse is such an inferior instrument in haulage that a comparison between it and the machine cannot be maintained after the point is reached where physical disability causes the former to retire from the contest.

* * *

In heavy work draft animals practically cease to offer competition to or comparison with motor wagons once the journeys exceed 11 miles from the base of operations. That distance, which seems to mark the limit of profitable haulage for horses in the heavier class of work, only enables us to observe the shadow of motor wagon economy. Long hauls are necessary for the establishment of the substantial value of the machine. In such work, within limitations, it has no rival. It is often superior even to the railroad. But it is worth while noting that, even within the field where both horses and motor wagons may be employed, the latter outclass the former whenever the loads are high. The economy of the machines, evident from the very first mile, gradually increases until at 11 miles or thereabouts there is no competing form of service with which it may be contrasted. If there is considerable activity of service the balance in favor of mechanical road transport is all the greater.

* * *

If we had reached that state of industrial development where the application of the motor wagon was as general as the employment of the horse it is absolutely certain that the economy of the machine would be much enhanced. Just now it has to put up with conditions which are unessential for its use and inimical to it. It is unscientifically administered, chiefly because it is associated with horses, operated over road conditions which are suitable for them, and set to performing tasks which in the main are hostile to machine labor. This is the period of clumsy application of the power wagon. By and by, as an enlightened public perceives how great are the disadvantages under which the machine displays its superior economy, conditions will be adjusted solely with the object of increasing it. The physical hindrances which now limit its employment will be removed, and we will enter the period when it will be surrounded with service conditions befitting its rating as a machine. It will not be administered as a waif which has to find a place in commerce, but will fit into a scheme of organization created for it, like the locomotive which pulls its freight on rails. Pending that time we must be content with the imperfect revelations of its economy which are vouchsafed to us. Happily they are complete enough to sustain present day faith.

* * *

The inconstancy of the principal factors in draft animal service, no less than its limitations, will always pre-

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vent an intelligent investigator from making a broad comparison between it and motor wagon performance. In individual services of a given character it is, of course, quite practicable to contrast the two forms of transportation, but the economy of the machines will in every instance be governed by such considerations as the number of units employed, speeds, nature of service, and the degree of skill manifested in their administration. The work of one machine in a stable filled with horses does not truly denote its efficiency. Only mass employment of machines will enable an investor to realize how great is the economy of motor wagon transportation.

Still there is satisfaction in knowing that even in modest and experimental installation the motor wagon proves its worth. Various forms of this proof are continually coming to light. All, however, are of that special character which prevents the investigator from boldly claiming that for given distances and loads the economy of the machine is precisely known. Edward R. Hewitt, of New York City, has faithfully watched the performance of some of his two, three and five ton gasoline trucks in work wherein the cost of draft animal service is accurately known. In the table shown on this page he records the results of these observations. It is singularly instructive to observe that throughout the comparison the machine never fails to show to advantage. Its superior usefulness increases with the length of haul until at 11 miles a point is reached where the competition of the horse disappears. If such great savings can be obtained from the use of single machines it is quite evident that the economy will be largely increased by a freer use of them.

Furthermore, as the figures in the table are computed upon the basis of one way haulage, it is plain that they do not do full justice to the motor wagon, nor accurately reveal the inefficiency of the horse. Were horses to be worked hauling full loads both ways, it would be necessary to greatly depreciate the values assigned to them in the table. On the other hand, were the machines employed at full capacity the cost of transportation as shown would be much reduced. Active work, which destroys the usefulness of the draft animal, raises our esteem for the motor wagon.

* * *

As the time consumed in loading and unloading is of great importance in estimating the cost of motor wagon transportation, Mr. Hewitt supplies a second table which indicates the allowances which must not be exceeded if the machines are to cover the mileage given in the cost table.

The 20-hour journey, much dreaded by travelers, between Vale and Burns, Ore., is to be shortened considerably by the employment of motor buses. The two towns are 140 miles apart. The trip will be made by machines in a little more than six hours.

Portland, Ore., is to be supplied with motor cabs. Eleven machines have been ordered.

Two pieces of motor driven fire apparatus will be installed in Mobile, Ala., within the next thirty days. The cost will be $8,000.

COMPARATIVE HORSE AND MOTOR TRUCK COSTS

	1 Horse Wagon 1 Ton		2 Horse Wagon 4 Tons		3 Horse Wagon 6 Tons		2 Ton Motor Truck 2 Tons		3 Ton Motor Truck 3 Tons		5 Ton Motor Truck 5 Tons		10 Ton Motor Truck 10 Tons	
Average Miles per Hour	4		3		2½		12		10		8		6	
Cost per Day	$4.00		$6.00		$8.00		$9.60		$10.38		$12.67		$15.63	
Miles from Base	Per Load	Per Ton	Per Load	Per Ton	Per Load	Per Ton	Per Load	Per Ton	Per Load	Per Ton	Per Load	Per Ton	Per Load	Per Ton
1	$ .39	$ .39	$ .60	$ .15	$ .88	$.146	$ .38	$ .19	$ .48	$ .16	$ .61	$ 125	$1.02	$ .108
2	78	.78	1 20	30	1 76	.29	76	.38	96	.32	1.22	.25	2 04	.216
3	1.17	1 17	1 80	45	2.64	.43	1.14	57	1 44	.48	1 83	37	3 06	324
4	1.56	1 56	2.40	.60	3.52	.58	1.52	.76	1 92	.64	2 44	.50	4.08	.432
5	1 95	1 95	3 00	.75	4 40	.74	1.90	95	2 40	80	3 05	.62	5 10	.540
6	2 34	2 34	3 60	90	5 28	.87	2 28	1 14	2 88	96	3 66	.75	6 12	.648
7	2.73	2.73	4 20	1 05	6 16	1.02	2 66	1.33	3.36	1 12	4.27	.87	7 14	.756
8	3.12	3.12	4 80	1.20	7 04	1.16	3 04	1 57	3 84	1 28	4 88	1 00	8 16	.864
9	3 51	3 51	5 40	1 35	7 92	1 31	3 42	1.71	4.32	1 44	5 49	1 15	9 18	.972
10	3 90	3 90	6.00	1 50			3 80	1 90	4.80	1 60	6 10	1.25	10 20	1 08
11	4 29	4 29					4 18	2.09	5 28	1.76	6 71	1.31	11.22	1 18
12							4 56	2 28	5 76	1 92	7 32	1.50	12.24	1.29
13							4.94	2 47	6.24	2.08	7 93	1 62	13:26	1 40
14							5 32	2.66	6 72	2.24	8.54	1.75	14.28	1.51
15			Limit of profitable horse haulage per day				5 70	5 85	7 20	2 40	9 15	1 87	15.30	1 62
16							6 08	3 04	7 68	2.56	9 76	2.00		
17							6 46	3 23	8 16	2.72	10 37	2 15		
18							6.84	3.42	8 64	2.88	10.98	2 25		
19							7 22	3.61	9 12	3.04	11 59	2 37		
20							7 60	3 80	9 60	3 20	12 20	2 50		
21							7.98	3 99	10.08	3.36				
22							8.36	4 18	10.56	3 52				
23							8 74	4 37						
24							9.12	4.56						
25							9 50	4 75						

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One of the fourteen Packard trucks used in the service of the Adams Express Company in New York City.

Adams Express Co. Buys More Trucks

By the addition of six Packard three ton machines the long haul and night service is greatly improved.

NO better evidence of the economy of the power wagon can be produced than is furnished by the action of the Adams Express Company in constantly increasing its investment in such machines.

In a general way it is understood that the Adams company favors the employment of the electric wagon. That it has a high appreciation of the merits of that type is quite apparent from the fact that its stations in Buffalo, Indianapolis, Rochester and New Haven are exclusively equipped with electrics. On the other hand, the company is very far from being indifferent to the special merits of the gasoline wagon, and, in fact, wherever its service is indicated has quite a number of them in use. This is especially the case in New York and other large eastern cities, where considerable territory has to be covered by the company's vehicles. In New York alone the company's mechanical equipment contains no less than 14 gasoline trucks, all of Packard manufacture. Six of these are models which the Packard factory produced a few years ago and are rated at 1½ tons. Eight 3-ton Packard trucks of recent design have just been purchased in order to relieve the severity of the work performed by the gasoline and electric machines of lower rating.

* * *

Considering the large sum of money which the Adams company has invested in motor wagon equipment it will be interesting to review its experience in relation thereto. Many years ago it experimented with steam driven wagons and found them unsatisfactory. Attention was then turned to the employment of electrics. The first lot of electric wagons installed in New York proved to be of higher rating than was economical for the service; that is to say, their speed being proportionate to their load it was found impossible to get the headway on the streets which was necessary in order to clear the merchandise offered for transportation. This condition led to the purchase of machines of lower rating and greater speed, 2,500 pounds now being the normal capacity of the great bulk of the company's electric vehicles. For the haulage of higher loads, especially in distant service, the company shows a decided preference for the use of gasoline wagons.

Once the company decided that motor wagon transportation was more desirable than horse transportation little time was lost in installing an extensive mechanical equipment. An order was placed with two factories for the delivery of 150 electrics. This transaction occurred about three years ago, at which time the gasoline wagon was but very imperfectly developed. In performing the work to which they were assigned these electric machines have proved to be exceedingly economical. The constancy and precision of their service would indicate as much. But as they could not be employed in long hauls, which of late have become very frequent in New York express transportation, the company was compelled to consider the use of gasoline wagons.

* * *

The work of the few gasoline machines which were first purchased created such an active demand for their service that the meager equipment proved inadequate, and it became necessary to augment it. It was but another instance of the motor wagon creating its own traffic. The service of an express company in New York is by no means confined to the area of the metropolitan district proper. It may, and frequently does, extend forty miles or more from the base of operations. Obviously such trips are beyond the capacity of the electric wagon.

The thoroughness which marks the Adams company's administration of electric wagons is also a characteristic of the management of its gasoline wagon installation. Throughout the year there is never a time when one of the electric vehicles is out of commission for a greater period than the length of a day. At all times the vehicle

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service efficiency of this division of the mechanical equipment is considerably above 90 per cent. Executive skill out of the ordinary is necessary in order to obtain such excellence of service.

Street transportation being one of the two principal sources of the company's revenue, it is perhaps natural to expect that all of its road vehicles, whether hauled by horses or mechanically driven, should be administered with more than common prudence. Nothing is left to chance in such an establishment. Drivers, though fashioned out of raw material, are very skillful. Inspection and repair work are given that degree of attention which is absolutely necessary if first class and consistent vehicle performance is to be obtained.

* * *

The company's electric and gasoline equipments in New York are kept separate, the latter being housed in a concrete building at 242 West 47th street. In this establishment there is a complete repair shop and a corps of mechanics under the charge of the superintendent of the company's various garages, who is generally accounted the most competent administrator in his field. This official is invested with more responsibility than his title might imply. He not only directs the care which is to be given to the motor wagons, but, from his intimate knowledge of the special properties of mechanical road transport, is intrusted with authority to route the machines.

* * *

The routing of a motor wagon, scientifically considered, is a matter which may very well engage the best talent available in an establishment employing machines. Ordinarily it is considered enough to route the mechanical units in the manner which custom sanctions for the routing of horse drawn vehicles. The employment of a few motor wagons may make this necessary or permissible, but where, as in the case of the Adams company, a large number of machines are employed, machine administrative practice should prevail. Theoretically and in practice there should be few unprofitable periods in motor road haulage. The machines should be worked to their full capacity in order to develop their greatest economy. Skill in routing, therefore, is of the very highest importance.

In addition to the duties already outlined the superintendent of the Adams company's garages is expected to define the work of the drivers, supervise their training and, what is of more importance, place limits upon their usefulness. The company's drivers, as might be expected from the contemplation of so thorough an adminstrative plan, are neither more nor less than handlers of machine tools. Those in charge of electric vehicles are not assumed to possess the qualities of an expert battery caretaker. They are not permitted to repair or adjust any part of the mechanism except while on the road. Even then only rough and ready service is expected of them. Similarly with the drivers who handle gasoline machines.

* * *

Two floors of the garage in which the gasoline wagons are housed are used as a stable for horses and a storage room for unemployed vehicles. The building, however, is in such shape that additions for the convenient maintenance of the motor equipment can be quickly undertaken.

The Packard 3-ton trucks are chiefly used in the work of transferring heavy loads from one of the express company's depots to another. There is a great deal of work of this character to be performed; consequently the machines are quite actively employed. They are also used when long journeys have to be undertaken.

* * *

A nice example of the economy of the 3-ton Packard trucks is to be found in the case of a machine which is employed in the express company's night service. This wagon runs between the Jersey City dock of the Adams company and its distributing station on 124th street in Harlem. It carries express matter from the garage on West 47th street to Harlem, and there is loaded with outgoing freight which is taken down to the ferry and over to the Jersey City docks, where the cargo is discharged and a fresh load of incoming express matter taken on and forwarded to 124th street via the 47th street station. During the night this machine makes a trip to Brooklyn, with incoming freight one way and outgoing freight the other way, also carrying freight which merely needs transferring between Brooklyn, 47th street and Harlem.

The manner in which this motor wagon facilitates the handling of both incoming and outgoing express at night has reduced the total time of through express delivery from points west of Harrisburg, Pa., by exactly 24 hours. This machine is not run during the daytime, except under press of unusual work, as the Adams company very wisely has allotted a portion of each day for each of its trucks to be in the garage in order to insure proper care and attention at the hands of its expert workmen.

Motor bus service is to be supplied between Evergreen, Idaho, the present terminus of the Pacific & Idaho Northern railway to Meadows, Payette lake, Roseberry and Van Wyck in Long valley. Four machines will be used on the route, one carrying 24 passengers.

The vehicles of one of Chicago's cab companies are provided with folding hoods which afford a measure of protection for the drivers. They considerably improve the appearance of the bodies.

Motor bus service is to be furnished between Ormond, Daytona and Palm Beach by the Florida East Coast Hotel Company, for the benefit of those who repair to those resorts.

The courts have enjoined the city of Akron, Ohio, from buying certain motor driven fire vehicles. Illegal methods of purchase were charged in the appeal.

An appropriation of $2,500 has been made by the Newark, N. J., board of health for the purchase of a motor ambulance.

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Chicago's Fire Chief Presents New Idea

He favors the abolition of heavy engines and the use of light motor driven apparatus.

IT requires no violent stretch of the imagination to evolve the fire fighting apparatus of the future—and the near future, at that. The automobile, both in its touring car type and its commercial vehicle aspects, is making an imprint on the municipalities. The full realization of this important development some day will come to the citizens of the second largest city on this hemisphere, when the smoking steamer, now one of the spectacular features of a fire, is missing.

* * *

Ever since I began to climb into executive positions in the Chicago fire department, and electricity has made big strides, I have cherished a dream of automobile fire engines. Prosaic compared to the snorting horses drawing the heavy steam cars, with their sparks and clanging bells! Not much! The practical and the picturesque would be mingled in the automobile fire engine.

But my idea, and one that is being worked out, although lack of municipal appropriations makes the work slow and unsatisfactory, is not to have automobile fire engines consisting simply of the ordinary steamers fitted to heavy chassis and propelled by motors. There is doubt if the tires would be able to stand up under this kind of a scheme. There also is doubt that a steamer could always be dispatched to its destination with promptness if the heavy steam boiler and pumps were rigged up to an automobile.

But what would be the matter with some heavy powered, moderately heavy automobiles, containing electrically driven pumps capable of sending streams many times the volume of those that come from the present up-to-date steam fire engine? Why not the fire fighting greyhound that could make twenty-five miles an hour or more on ordinary roads, in response to an alarm of fire, carrying only a complement of firemen and a pump that could be operated from an electric current?

This system would eliminate not only horses, but all the discomforts of steaming up for service, carrying coal, and providing many teams for the purpose of replenishing coal supplies at a big fire. The city should have its own electric current. There is an abundance of power at hand in the drainage canal zone, and this current might be carried over municipal wires to every fire plug in the city.

* * *

In protected boxes near the fire plugs the electric connections could be installed that would feed the power to the electric pump motors of the automobile fire engines. Just by slipping in a plug or connection from the motor in the automobile to the city current, the modern fire engine would be in commission in an instant. There would be no stoking to keep up steam, no cinders, sparks, shrieking whistles, and confusion, and above all, no delay. Two seconds after the arrival of the apparatus at the fire plug the pumps could be working and if the automobile hose truck that accompanies the electric motor-pump automobile to the fire has no delay the leads of hose could be strung ready for service about the time that the electric pumps were in action.

* * *

It might be said that there would be danger of the electric current not being on. There might be some great disaster that would cripple the electric power zone, but if it did there would be other ways of getting power. Each new style electric fire engine could be provided with emergency apparatus whereby connection could be made with the nearest voltage—it might be that of a trolley wire or the line of a private electric corporation.

If a steamer's pumps could be depended upon to throw a stream of, say, 300 gallons per minute, and an electric pump could demonstrate an efficiency of two or three times that amount; and if the cost of getting service on a fire were to be reduced many fold by the electric pump automobile, what group of city aldermen would hesitate to spend the money to provide such apparatus?

* * *

Experiments have been conducted in a small way with gasoline propelled motors attached to chassis containing the electric pumps, and they have demonstrated to my satisfaction that the electric current scheme not only is immensely superior to the old idea of hauling steamers through our streets, but that it is likely to effect great economies. The large cities must come to something like this to be reasonably safe from general conflagrations.

While it is true that in making my requests for new apparatus for Chicago in order to get an increased appropriation for 1909 I have not taken into account the electric pump automobile engine, it is obvious that there must be an installation of electric power for all the fire plugs of the city before such a plan could be put into operation. Meanwhile, Chicago will continue to fight fire with the steamer drawn by horses unless wise men should figure that the much discussed high pressure system would be better than the substitution of the electric pump engine for the steamer.

Under high pressure system efficiency the heavy steamer would be displaced by a light rig that would get the hose leads into commission at the water plugs. Electricity, however, is a wonderful power, and I maintain that the day is coming when the enormous power of the drainage canal, which should be at the disposal of the city, will be utilized in furnishing current for fire fighting pruposes.

JAMES HORAN,
Fire Marshal City of Chicago.

The proprietors of Wagner's circus are considering the use of twenty-five motor wagons in transporting their paraphernalia throughout the country next summer.

The trustees of Los Angeles, Calif., have authorized the purchase of a motor-driven hose and chemical wagon.

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The Wages of Drivers.

An automobile agent makes a plea for payment at the rate current among drivers of pleasure cars.

QUITE recently an agent for a well known motor truck expressed the following opinions concerning the compensation of drivers:

"One of the greatest hardships experienced by business houses using the commercial motor car has been the lack of competent men to handle the machines. The real reason at the bottom of this is that the drivers are not paid enough money for this kind of work. For commercial car drivers only $10 to $15 a week is paid; for chauffeurs on pleasure automobiles $20, $25 and even more a week is paid. It is no wonder, then, that men turn almost entirely to the pleasure car rather than the commercial car. Once the business men appreciate this, the value of their investment in a commercial machine will materially increase, for competent machinists will keep them in order."

* * *

The author of this statement is profoundly ignorant of the facts in the case. In the first place few, if any, motor wagon drivers receive such small compensation as $10 a week. At the least the wage is equivalent to that of teamsters, which in nearly all large cities fluctuates between $12 and $15. In no case worth considering is a machine operator paid less than his services as a teamster can command. In the next place, not one man in a hundreds who drives a touring car is paid such fancy wages as $20 or $25 a week. Some may earn more in tips and gratuities of one sort and another from the employer and his friends, but they are exceptionally well favored. The majority get no more than $15 a week. They are rated as coachmen, not as mechanics of a superior order.

* * *

The price paid for a motor wagon driver's service does not necessarily indicate his skill or insure proportionate economy in the vehicle intrusted to his care. The villainous records of thousands of paid touring car drivers in a measure establishes the truth of this assertion. These chaps, representing the aristocracy of their guild, are wasteful and negligent. Lately their social status has been undergoing a change. Ranking as coachmen, they are expected to perform all the duties of such servants, rendering domestic aid in the house of their employer when they are not on duty in the street or road. The mechanics among them are rapidly being thinned out. Moreover, as time goes on stable hands of all kinds are being broken to automobile service. The ability of many of these as drivers of touring cars and motor wagons is unquestioned. They are undoubtedly worth a little more than formerly to their employers, but since their new training is accomplished at the employer's expense it is at his discretion their compensation is fixed.

* * *

It is a serious error to suppose that the mass of touring car drivers have any aptitude for piloting motor wagons. As a body they would refuse such humble and arduous service. Wagon drivers are not liveried dudes. Social aspirations do not prevent them doing all kinds of rough work, such as lifting and placing merchandise. They must know the business of transportation and they must conform to its changes. Recruits from the stables are put in charge of machines. At first they perform their new duties bunglingly. But they do better as time goes on. If they prove unfit for advancement they are rejected.

* * *

Let us see how this recruiting process really works out. Nearly all the London motor bus drivers—and they are 2,000 strong—are experienced horse drivers. They know no more about mechanics than codfish. Of the 300 odd electric wagon drivers employed by the Adams Express Company few have had antecedent experience which captious critics would consider as qualifying them for their present positions. The great bulk of them only knew how to guide a horse till they were taught how to work a controller and steering wheel. Most of the motor cab drivers here and abroad have handled the ribbons. The Anheuser-Busch Brewing Company employs 65 motor wagons and the men who drive them are picked from the stable.

Hundreds of other examples could be cited to show that there is no scarcity of raw material out of which commercial motor vehicle drivers may be fashioned, and, what is of more importance in the present hour, that there is no serious loss incurred in doing so. The evolution of the teamster from a low to a high plane is not a speculation. It has been accomplished in thousands of instances. Nothing is to be gained by lamenting the difficulties of such a development.

* * *

Business men rightly decline to consider the drivers of motor wagons as machinists. If the latter must be employed their proper place is in the garage. The chief duty of a driver is to drive. The moment he is permitted to dabble in repair work, without having the qualifications for it, he is on dangerous ground. He should, of course, know something of his machine and be able to make minor repairs and adjustments. But he should not be encouraged or allowed to usurp the functions of men with mechanical training and instincts.

The success of the motor bus service between Palo Verde and Los Angeles, Calif., has been so pronounced that the proprietors have decided to double the equipment.

The city authorities of Salina, Kas., recently went to Hutchinson, Kas., to witness a demonstration of the motor hose and chemical wagon in service in the latter town.

Notwithstanding a heavy deficit in the charities department, the mayor of Bridgeport is urging the purchase of motor ambulances.

Automobiles are being used to move the tobacco crop by farmers of the Connecticut valley.

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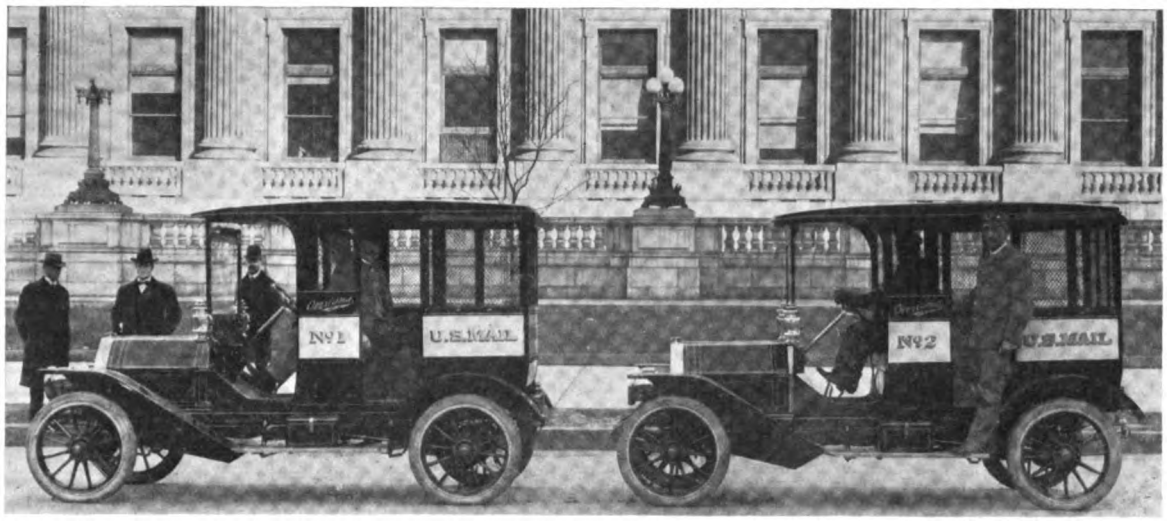

Machines employed in postal service in Indianapolis.

Motor Mail Service in Indianapolis.

The work of two machines, leased for a year, greatly aids collection and delivery.

WITH the object of decentralizing the service, and thus greatly facilitating the distribution of mail matter, two motor vehicles have been placed in commission by the postmaster of Indianapolis. As a result of the employment of these vehicles carriers serving distant districts no longer have to return to headquarters in order to have their pouches filled.

The wagons, which are the product of the Overland Automobile Company, of Indianapolis, are leased by the makers to the government. The owners supply the drivers and are responsible for the upkeep of the machines. A feature of the construction of the vehicles is that the driver does not have access to the interior, the front seat being divided in such a manner that the postal official in charge rides facing the rear, and consequently always has the contents of the wagon under his eye. The machines are painted in the national colors, and are upholstered in bright red leather. The body is enclosed with very heavy wire netting and is provided with roll curtains to protect the interior. The driver is protected with a stationary glass front. The engine develops 30 hp.

* * *

Collection service from outlying districts is also performed by these machines, which will be tested for the period of a year in order to ascertain just how valuable such auxiliaries are in the local postal service. During the early hours of the morning the machines are used in making "drop" deliveries to the downtown business houses. Later in the day they are employed in transporting mail to distant depositories in various parts of the city, thus facilitating the work of the carriers and greatly lightening the burdens of their routes. When the carriers have delivered all the mail which in the original instance they take out in their pouches, they go to the depositories and have their supplies replenished.

The total weight of each wagon is about 2,100 pounds. The bodies are made of pressed steel. The wheel base is 110 inches. Both machines are fitted with pneumatic tires, 32x4 inches. The top of each vehicle is 8½ feet from the ground. In the body of each machine there is a working space of 39 by 49 inches, exclusive of the room required for the postal official and driver.

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These vehicles have now been in service for about a month. To indicate the value of their work it is enough to say that in one test collection in the outlying districts the mail from 26 boxes was gathered in thirty minutes, while on one of the horse routes which requires 3¾ hours to cover a motor mail car was started over the same route one hour late and reached destination three-quarters of an hour sooner than its rival, the total gain in time being 1¾ hours. It is also quite interesting to know that both machines are regularly beating the time schedules which were officially planned. It is, of course, a comparatively easy matter to do this with the available engine power, but the point to be considered is that the postal officials did not think it possible to improve upon the time schedule which they themselves had drawn up.

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One of the most important services performed by the machines is the collection of mail in some of the outlying districts after nightfall. Their work in this respect enables mail to be received in the postoffice in time for distribution to the midnight trains. Before the machines were employed in this latter service it was customary to start horses to the outlying districts two hours earlier than is the case with the machine, and even then it was not certain, as it is now, that the postoffice would be able to handle the mail for outgoing midnight distribution. Furthermore, when horses were performing this work, many outlying districts had no night collections at all.

Each machine averages between 40 and 50 miles a day. Both were designed by William H. Brown, vice-president of the Overland company.

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Solid vs. Pneumatic Tires.

Instructive comment by a maker who has made many experiments with both forms of construction.

HAVING noticed an article on comparative tests made between solid and pneumatic tires, I am prompted to give a little of my experience as the patentee of twenty-two different types of both solid and pneumatic tires and as the promulgator of crosswise tires which now are well known in all countries.

Before commenting upon the report on tests made, I wish to say that we will admit generally that there is no tire as easy riding and which causes less vibration on a motor driven vehicle than a pneumatic tire, provided the same is not too highly inflated.

In reporting tests, however, between solid and pneumatic tires, it is the plain and honest duty of the reporter to state at what pressure the pneumatic tire was inflated when the test was made, as well as the solidity to which the solid tire was cured and the shape thereof. Solid tires can be cured to such a carrying capacity that one cubic inch will carry 500 pounds without yielding ¼ inch, while it can also be cured so that a cubic inch of rubber will only carry five pounds to yield the same distance, and without the reporter giving the consistency or carrying capacity to which the solid tire was cured, the report is of no account and cannot be used to enlighten the inexperienced.

* * *

The writer's experience has proven that a solid tire not properly formed—that is, cured so hard that it will, on a rough pavement, bounce from one coblestone to the other and will not keep down to the roadbed—is very little better than a steel tire; but on the other hand when the tire is molded in such a manner that there will be one portion of it always compressed, so that when the wheel strikes an obstacle in the road (which has a tendency to raise the wheel off from the roadbed), this portion of rubber will pop down and keep in contact with the roadbed and prevent the wheel, which would be off the ground, from acquiring a very high speed while the car almost comes to a standstill, thus losing power and grinding off rubber unnecessarily when the wheel again comes down to the earth, entirely different results are shown.

We insist that solid tires must be kept down to the pavement in order to ride comfortably and in order that you can acquire a high speed. It is no difficult task whatever to acquire a speed of from 25 to 45 miles an hour on solid tires, provided there is a bead on the tread of the tire which will, with a normal load, be compressed to the extent of ½ inch, so that when you strike an object that has a tendency to raise the wheel ½ inch, this bead can relieve itself and assume its normal shape and reach down and keep the wheel in contact with the road.

* * *

The writer had at one time designed tires that were placed on high speed cars capable of running 50 miles per hour. The tires were smooth treads and cured rather hard. They were cured with a view of acquiring carrying capacity rather than comfortable or fast riding and it was impossible to make more than from 18 to 19 miles per hour on reasonably good pavements, as the tire was off the pavement nearly half the time, and when it would come down the tire had acquired such a speed that when the wheel struck the pavement it was as though an emery wheel would come in contact with a piece of chalk—the roadbed would grind the face of the tire down so that there soon would be nothing left on the rim.

Finding this unsatisfactory, we removed the tires and placed upon the same wheels tires with a center bead measuring about ½ inch high. This bead was compressed completely out of sight as the car stood on the pavement.

While running the car, we found it a very easy matter to acquire a speed of 40 miles per hour over the same pavement on which it was impossible to get a speed of 20 miles per hour with the hard, smooth face tire, and we would acquire this 40 mile speed with less fuel than was used with the hard tires when we were scarcely making 19 miles per hour.

After having made this experiment and found that the speed to be acquired on solid tires depends upon the tires being softly cured and provided with a bead that would quickly adapt itself to the unevenness of the roadbed, we have decided that the art of successfully making use of solid tires will depend greatly upon the judgment exercised in shaping and curing the rubber and the proper application of the same to such loads as they are adapted to. All solid tires should be loaded, in order to acquire a rapid speed (without too much vibration) to nearly their full carrying capacity, with good buoyant springs between the axle and body of the car. Tires for electric cars used on pavements generally should have narrow treads.

* * *

My experience has also led me to believe that while pneumatic tires generally prevent vibration, they can be inflated so highly and solid tires can be cured so softly and built so high above rim that when the two are passing over the same obstacle side by side at the same speed, the pneumatic tire will rise 50 per cent higher in passing over the obstacle than the solid tire will, and consequently cause more vibration.

J. A. SWINEHART.

Akron, Ohio.

Governmental statistics show that there are only 43,450 miles of macadam roads in the country. From the same source it is learned that we can only boast of 124,468 miles of gravel roads. There are 2,151,000 miles of roads of all kinds, good, bad and indifferent. The average cost of our macadam roads is $4,500 per mile, of our gravel roads $1,500 per mile. The 1,975,000 miles of dirt roads have cost $500 a mile.

An experimental motor cab service is to be established in Worcester, Mass. Three machines will be employed at the start.

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The Automobile as a Snow Remover

Two incidents which demonstrate the inefficiency of present municipal equipment for cleaning streets.

MUNICIPALITIES are very slow to perceive that in the automobile they have the most efficient and economical instrument for cleaning streets which has yet been devised. The inherited tendency to continue the use of means which long custom has sanctioned is more difficult to eradicate in large corporate bodies than in individuals. The horse persists in municipal administration when on every hand it is being superseded in the affairs of individuals.

* * *

The cleaning of streets in winter time is a matter of very considerable public importance. The frequency with which snowfalls occur causes great commercial loss through the impediments to traffic which they create. Upon such occasions the departments having control of streets bend every effort to restore conditions to normal. In doing so they spend public money liberally and without much appreciable advantage. In cities like Chicago the work of 50 motor wagons of adequate power would easily do as much work as 300 teams in clearing streets of snow and carrying it to points where it might be dumped. It is not necessary that these machines should be exclusively employed in such work. It is, however, of vital consequence that they be available when their special service is indicated. A good many millions of dollars are annually spent by our principal cities for the removal of snow by means of men and horses when motor wagons would perform much more effective service of a like character at a fraction of the cost.

* * *

Occasionally private enterprise in such a matter shames the municipality. An instance of this is to be found elsewhere in this issue. The traffic superintendent of a large brewery, having an extensive motor wagon installation, recently found it necessary to clear paths for the machines in the vicinity of the plant by the construction and employment of a hastily created automobile snow plow. This undertaking seems to have created no special surprise, except insofar as it struck observers that the mode of procedure was novel. It does not seem to have occurred to anybody that a large tax paying firm was, at its own expense, performing work which it was the duty of the municipality to undertake.

Removing snow from streets in Indianapolis.

In Indianapolis last month another example of individual initiative in street cleaning was observed, and here again the same spirit of municipal indifference was manifested. Upon this occasion an automobile factory, that of the Premier Mfg. Co., was practically snowbound, a circumstance which seriously interfered with the open air testing of the company's product. As much for its own convenience as for that of the public, the company constructed a V-shaped plow and attached it to one of their testing machines. In the factory neighborhood the street car lines are not as numerous as they are in more populous sections of Indianapolis, and hence there was an unusually large area to be cleared. The machine was first driven over the sidewalks, and snow to the depth of 9 or 10 inches removed. In this manner, within the course of an hour and a half, 31 miles of sidewalk had been cleared. Later in the day the streets adjacent to the factory were put in shape for traffic by the means under consideration. Probably a complacent representative of the city government would, if he had heard of the matter in time, have remonstrated with the people who thus public spiritedly violated a civic ordinance in running a road machine over a surface intended for pedestrians.

OPERATING UNDER DIFFICULTIES.

ABOUT a fortnight ago St. Louis was visited by a heavy snowfall. The superintendent of the traffic department of the Anheuser Busch brewery, which employs over 60 motor wagons, soon found it necessary to clear the streets in the vicinity of the establishment if the machines were to work at anything like full capacity. So he set seven men to work constructing a hastily devised snow plow. The job was completed in 20 minutes. The instrument was attached to one of the company's five-ton Couple-Gear electric trucks and dragged around the streets in the neighborhood of the brewery. It was weighted with twelve sacks of sand and ten men. Inside of an hour they had clear passageway for a very considerable area. All four wheels of the machine being driven by individual motors, it was easy to secure high tractive efficiency under the trying circumstances.

CAB COMPANY FORMED IN TORONTO.

WITH the assistance of new and old world capitalists a company has been formed to operate 100 motor cabs in Toronto, Canada. The capital stock of the company is $500,000. The title of the concern is the Berna Motors and Taxicabs, Limited. French machines, such as are so numerous in New York City, will be employed. The first lot of ten cabs will be commissioned next month.

The motor bus transfer line between Elm Grove and Wheeling, W. Va., will probably soon be extended to West Liberty.

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AMERICAN EXPRESS CO. TO USE MACHINES.

FROM good authority it is learned that since the severance of business relations with the fixed rail line which has carried the American Express Company's Brooklyn, N. Y., merchandise for ten years past, motor wagon transportation has been regarded as the only economic substitute. Meanwhile the express company is endeavoring to accomplish as much of its work as possible by means of horse drawn wagons, the limitations of which are well known to those establishments which have to live out of road transportation.

The example of the Adams Express Company, which employs hundreds of motor wagons, should inspire its rival to do something more than merely experiment with machines. The Adams company's installations, which are to be found in various cities throughout the country, were never considered as experimental. A heavy cash investment has from the first backed the idea that motor wagon transportation is at every angle of comparison much more economical than horse transportation. The Adams company now employs in the neighborhood of about 350 machines, representing an investment of considerably more than $500,000. It never for a single instant considers the permanent retention of horses. It is in fact, continually increasing its investment in motor wagons.

The apathy of the American company, considering the wonderful precision and economy of its rival's machine service, is a matter of constant wonderment to the trade. Years have passed since the Adams company first began to invest in machines, and during the intervening period it is safe to say that the American has lost much of its reputation for celerity of service.

The time for large express companies to purchase motor wagons is not when they are driven to it by competition or by the termination of existing contracts with other carrier means, but when the machines are available as an economic substitute for horse transportation, a condition which has been in existence for a good many years past.

Concerns dealing heavily in road transportation, with the solitary exception of the Adams Express Company, are notoriously slow to take advantage of the superior usefulness of the self-propelled vehicle. Possibly it is the extensive nature of the investment to be converted which makes them timid about effecting a radical change. They may feel that they can not afford to take a step in the dark. If they entertain any such opinion they are only deluding themselves. As matters stand today, the supply of motor wagons is not equal to the demand. By the time large teaming establishments are prepared to buy with liberality they will in all likelihood be compelled to assume places far down on the waiting list. Overcaution is always penalized, sometimes by missing profits which competitors secure and occasionally by having expectations cheated when a decision has been tardily made.

Hartford, Conn., is to be furnished with motor cab service.

GOOD WORK OF MOTOR SALVAGE WAGON.

PROVIDE the conditions under which draft animal service is seen at its worst and you have the exact conditions under which a motor wagon is seen at its best. This is an axiom in circles where the relative advantages of both forms of transportation is intelligently regarded.

A very interesting incident occurred in St. Louis not long ago which lends picturesque support to this opinion. The salvage corps of that city is provided with a motor wagon which has many conspicuously useful examples of service to its credit. On January 12, while a severe snowstorm raged, an alarm of fire was turned in from a residence district 15 miles distant from the machine's station. Within twenty minutes after the alarm had been received the motor salvage wagon was at the scene of the fire. A horse drawn hose and chemical wagon, as well as a horse drawn fire engine, which attempted to reach the fire were unable to proceed along the roadway and went out of action. The speed of the motor wagon permitted it to quickly reach destination and hold the loss down to the insignificant sum of $200. It is the opinion of the owner of the property that if the machine had not been in service the loss would have been total. Two hours elapsed before the horse drawn vehicles returned to the station.

COMBINED COMPANIES TO USE MACHINES.

MOTOR wagon transportation will be an important feature in the business of the Home Delivery Company, of Hackensack, N. J., which has been formed of three competing units, namely, the Mutual Transfer Company, Bannigan's Express, and the Fort Lee Transfer Company. The new organization will provide motor wagon transportation between New York and northern New Jersey towns. The board of directors is made up of Senator Wakele, County Clerk John R. Ramsey, Cornelius Doremus, George M. Slinerland and Albert I. Percy. Mr. Percy is president of the Federal Transit Company of New York. Mr. Slinerland is president and general manager of the new company.

Last October the motor buses of Berlin carried 2,250,000 passengers as against 1,350,000 passengers for the corresponding month of 1907.

There is talk of creating the office of Superintendent of Municipal Automobiles in New York City. There are 100 machines to be cared for. They are valued at $280,000.

Edwin A. George and G. W. Blake, of Wyandotte, Mich., are backing a motor express service which is to be maintained between Detroit and western suburban points, including River Rouge, Delray, Wyandotte, Trenton and other adjacent territory. A number of power wagons are to be used, and a central collecting station is to be maintained in Detroit. The service starts February 1.

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The Second New York Show

It proves to be even less representative of the industry than the first national exhibition.

LAST month we voiced the discontent which manufacturers of commercial motor vehicles felt over the inadequate representation made, and to be made, of their product at the three great automobile exhibitions of the year. The second of these shows, held in the Madison Square Garden, New York City, by the Association of Licensed Automobile Manufacturers, is now a part of recorded trade history, which few will care to peruse in the years to come in the expectation that it will reveal the prominent place which mechanical road transport occupies in public esteem at the present moment.

Hidden in a basement inaccessible to the multitude of visitors, the commercial vehicle exhibits seemed even lonelier and fewer than at the first New York show. All told there were but eight exhibitors, five making gasoline models and three electrics. Neither division of the industry presented an appearance from which the public could derive accurate impressions concerning its nature or extent.

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It is now quite apparent that if the commercial motor vehicle industry is to derive either profit or advantage from making a public display of its products the only hope of accomplishing such an end is to conduct an exhibition in which they would be assigned the most important, and not the least conspicuous, floor positions. More money has been spent in providing misrepresentation of the industry up to date than would cover the cost of holding a show exclusively intended for business machines. Either the power wagon and its related forms of construction should be separately and representatively staged, or they should not be shown publicly at all. Microscopic representation at a time when the industry is supposed to be on review can have no other effect than to mislead general opinion and do damage to the commercial pretensions of those connected with the industry.

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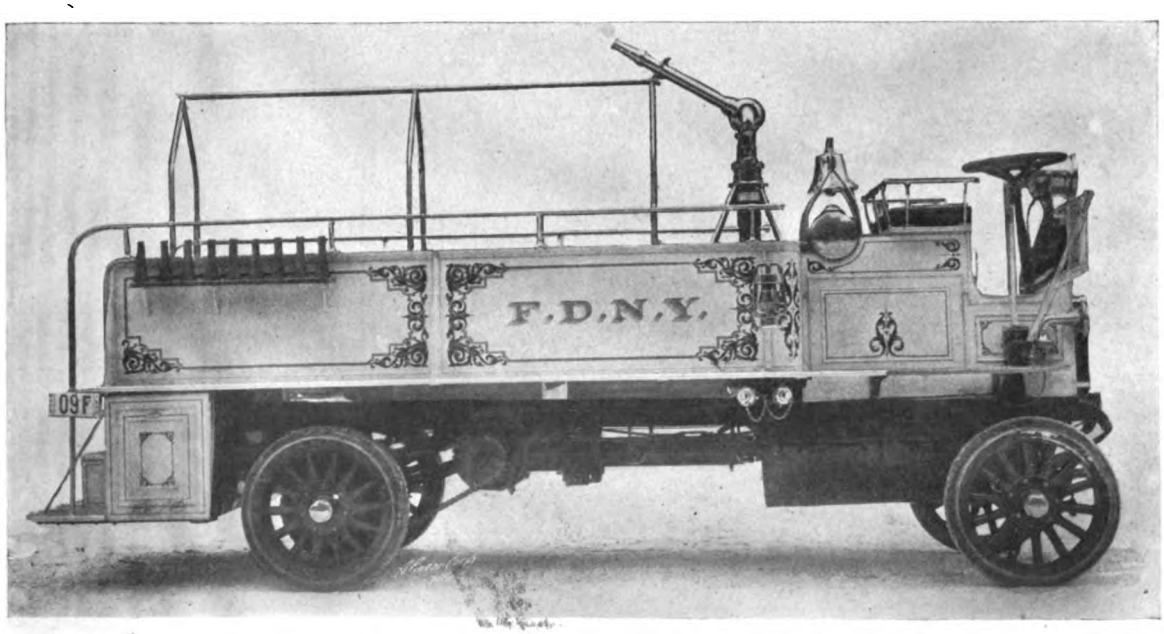
The exhibits at the second New York show were as follows:

Knox Automobile Co., Springfield, Mass.

The models made by this company range in rated capacity from 1,500 pounds to five tons. Many of these machines are adaptable for other purposes than the mere transportation of merchandise. The 2,500 pound chassis, for example, is available for bus work as well as for sight seeing purposes. The engines of the lighter wagons are air cooled, while those of the heavier type are water cooled. The four and five ton trucks are fitted with 60 hp. water cooled engines, 4 inch I-beam front axles, 2½ inch square dead axles, roller bearings for all road wheels, 5 inch channel steel main frame, dry cell and magneto ignition, selective type sliding gear transmission and double chain drive. Their maximum road speed is 12 miles per hour. The two and three ton trucks are fitted with 40 hp., air cooled engines, I-beam front axles, square rear axles, selective transmission, double chain drive, dry cell and magneto ignition, 5 inch channel steel frame and roller bearing road wheels. Both the two and three ton models have a maximum road speed of 15 miles per hour. The 3,000 pound model, and all those rated lower, are fitted with planetary transmission and two cylinder, air cooled engines. The motor and transmission of these models can be quickly removed if necessary. Other information pertaining to the company's product will be found in the tables of manufacture published elsewhere in this issue.

Two fire department vehicles shown by this concern attracted a great deal of attention at the hands of the public. One was a hose and chemical wagon and the other an extra first size water tower and hose wagon which develops extremely high pressure and is capable of throwing a higher stream than almost any other wagon of its type now in service. This latter machine was built for the New York fire department. In the district in which the high pressure system is used machines of this class will be much more serviceable than the old style fire engines drawn by horses. They are able to carry much more apparatus and reach



Knox extra first size water tower and hose wagon.

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the scene of a fire with much greater dispatch. It is probably only a question of a short time before they entirely supersede horse-drawn apparatus. The machine on exhibition weighs five tons and has a speed of 30 miles an hour. Both of the fire department models are equipped with four cylinder engines.

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Studebaker Automobile Company, South Bend, Ind.

This firm exhibited a five-ton truck, a 2,500-pound express wagon, a 1500-pound delivery wagon, an 800-pound delivery wagon, a 1,500-pound capacity station bus and an 800-pound ambulance—all electrically driven. It makes many more models than were shown, notably those rated to carry two tons and 3½ tons. The five-ton truck is fitted with two motors. The battery contains 44 cells. The vehicle will travel 27 miles on one charge over level and hard surfaces with average load, assuming that average load is two-thirds of rated weight capacity. Under the above conditions the maximum speed is 6¼ miles per hour. The gauge is 73¼ inches. The wheel base is 10 feet 6 inches. Front tire dimensions are 36 by 7 inches. Rear tire dimensions are 36 by 4 inches, twins. The 2,500-pound express wagon is fitted with two motors and a 40-cell battery; traveling radius, 35 miles with average load; speed, 9¼ miles an hour; gauge, 58½ inches; wheel base, 111 inches; front and rear tire dimensions, 36 by 4 inches; total weight of vehicle, 5,600 pounds; weight of battery, 1,760 pounds. The 800-pound panel slide delivery wagon is fitted with single motor. It has 24 cells; range, 30 miles; speed, 12 miles per hour; side lever steering; gauge, 54 inches; front tire dimensions, 36x2½; rear tires, 42x2½; total weight, 2,700 pounds; battery weight, 794 pounds. The 14-passenger omnibus is fitted with two motors. The battery contains 40 cells. The radius of this vehicle on a single charge is 35 miles at a speed of 9¼ miles an hour. The machine is wheel steered. Its extreme length is 14 feet 9 inches. It is 73 inches wide. Wheel base is 111 inches; tires, 36x4; gauge, 58 inches.

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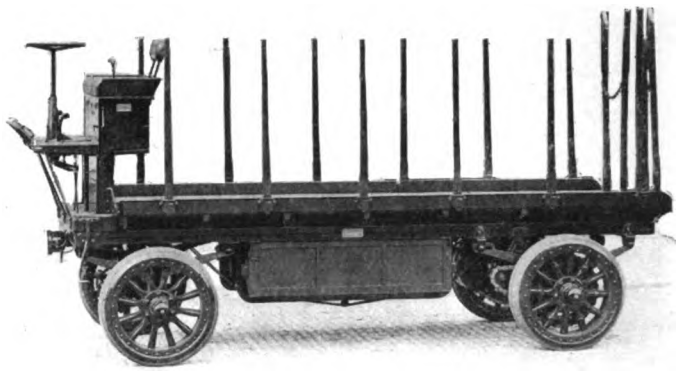
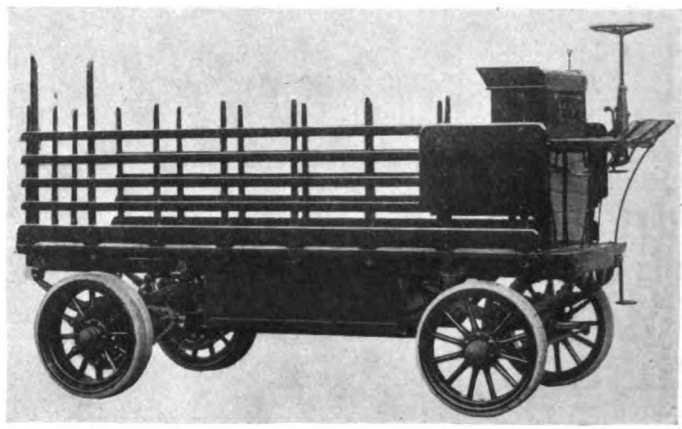
Alden-Sampson Mfg. Co., Pittsfield, Mass.

This firm, which last year brought out a gasoline-electric road train capable of hauling 20 tons, is now building a four ton gasoline truck which shows evidence of unusual care in design. Eight fundamental principles of construction guided the author

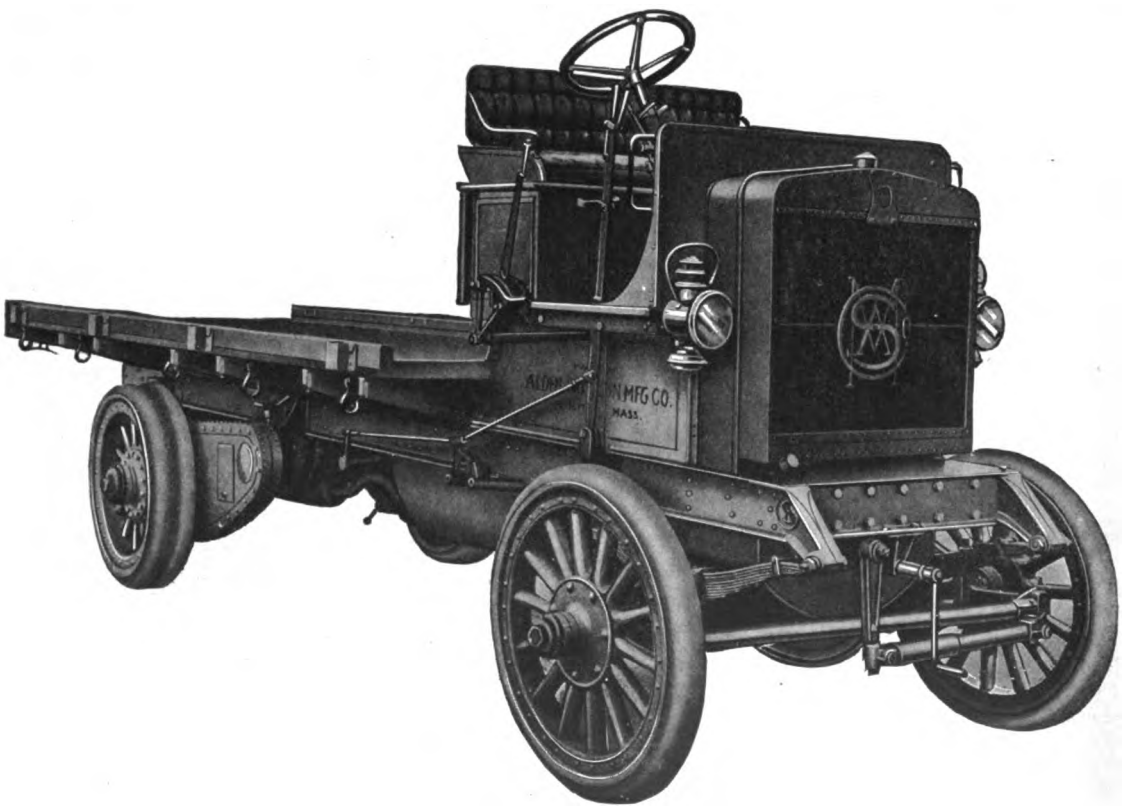


Studebaker 5-ton truck.



Studebaker 2-ton truck.

of this truck, which is fitted with a four cylinder, water cooled 40 hp. engine. These are: 1, accessibility and interchangeability of all parts; 2, engine and change gear units should be unaffected by any distortion of the main frame; 3, units should be connected so that any possible movement relative to each other is provided for; 4, all bearing and wearing surfaces and all working parts should



Alden-Sampson 4-ton truck.

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be extra large, and thoroughly protected from dirt and moisture; 5, brakes should be large and powerful, with provision for quick adjustment; 6, lubrication should be most thorough and automatic; 7, all parts should be easily accessible for inspection or adjustment; 8, great strength of parts but unnecessary weights avoided. The engine is mounted on a sub frame which relieves the engine of all strains which would be caused by traveling over uneven road surfaces. The gear box unit, including differential and service brake, is hung from the main frame by three spherically seated bearings. The engine is designed to run at 850 r. p. m., normal speed, giving a piston speed of 750 feet per minute. Ignition is by high tension magneto and dry batteries. The former is used for normal service, and the latter for starting or in emergency. A distributor is provided to which the wires from the magneto can be transferred, thus giving an additional emergency ignition system and insuring no delays from this source. Cooling is accomplished by means of the thermo-syphon system. The usual pump, however, can be supplied where work under unusual conditions, or in tropical countries, make a mechanical acceleration of the water desirable. The radiator, of special design, is mounted so simply that in case of damage it can be removed and replaced in a few minutes. The clutch is of the cone type. The propeller shaft transmits the engine power in a straight line. The selective sliding transmission gear gives four forward speeds. The gears are all 5 pitch and of very wide face. In the gear box, and operating on the gear shifter rods, is a one piece positive interlock, making it impossible for any gear to move or to be moved out of neutral position while another set is in either full or partial engagement. The differential is extraordinarily large and heavy. A lock gives a positive drive to both wheels when desired. Gear case, differential and sprocket shafts are mounted on annular ball bearings. The service brake is operated by a foot pedal and acts upon a 14 inch drum of 4 inch face placed upon the direct drive shaft between the gear case and the differential case. This is a locomotive type of brake, with removable shoes, and balanced, throwing no load except torque upon the shaft or bearings. The hub brakes are of the expanding shoe type, of large diameter and wearing surface. They are set by a hand lever and are equalized, insuring an equal pressure upon each wheel. A material braking effect can also be secured by throttling down the engine. The setting of this brake withdraws the master clutch, calling for but one motion to stop the truck in an emergency. The final drive is by chains. The chains run in a dust proof, oil tight sheet metal case, which acts also as a distance member for the rear axle and to carry the torque of the hub brakes. This case is spherically hung at the forward end, relieving it from all strains, and with a simple eccentric chain adjustment of utmost accessibility. The cases are provided with instantly removable inspection and adjustment covers. The use of chain cases is the largest factor in the life and efficiency of the side chains, one of the most important elements of the driving mechanism. The life of an enclosed chain is from five to six times that of an exposed one. The frame is constructed of rolled steel channel section of a uniform depth of 6 inches. All the lines are straight. At a point nearly over the rear axle, heavy angle iron diagonal braces are riveted in, insuring a frame strongly braced against corner blows. The frame is supported upon semi-elliptic springs. The rear springs act at the rear end against auxiliary coil springs, which are of a capacity to carry the truck body while unloaded, but close under further load at a point where the main leaf springs have the desired resiliency. Both front and rear axles are forged to deep I-beam sections. So much of the rear wheel which includes tire, felloe and spokes is built up on a false hub or center, which is slipped on and bolted to the main hub, allowing a quick change of wheels without the necessity of disturbing the chains, chain case or wheel bearings. The weight of the chassis is 6,000 pounds. The tread is 68 inches.

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Hewitt Motor Co., New York City.

The ten-ton gasoline truck made by this concern has attracted a great deal of attention. Other models manufactured are rated to carry two, three and five tons. The big machine is fitted with a four-cylinder, vertical, 28 h.p. engine, A. L. A. M. rating. It is fitted with twin tires of block pattern, 5 inches wide, in front. The rear tires are also of block pattern, 7-inch twins. The front tires are 36 inches in diameter; the rear tires are 44 inches in diameter. The brakes, of the internal expanding order, are applied on rear hubs and differential. The normal road speed of the machine is about 6 miles an hour. The wheel pressure on the ground does not exceed 700 pounds per inch of tire width. This is much less than is usual with horse drawn vehicles, with which the loads quite commonly exceed a ton per inch of tire width. Special roller bearings are used on the rear axles. This truck, as well as the firm's five-ton machine, may be operated with an alcohol engine, allowing the vehicle to be taken on steamship dock piers. The alcohol motors, however, cannot be operated on gasoline. The Hewitt company believes that the cost of operating an alcohol motor five-ton truck is $1.25 per day less than the cost of operating a gasoline motor truck of the same rating. The pressed steel frame of the ten-ton truck is 9 inches deep. The wheel base is 11½ feet. The tread is 68 inches. The transmission is of the planetary type, with two forward speeds. The final drive is accomplished by means of 2-inch side chains. The company's two and three-ton models are fitted with a 24-h.p. double opposed engine and planetary transmission. They also are double chain driven. The five-ton machine is supplied with the same engine as the ten-ton unit, the same style of transmission, and has the same depth of frame, wheel base, and gauge.

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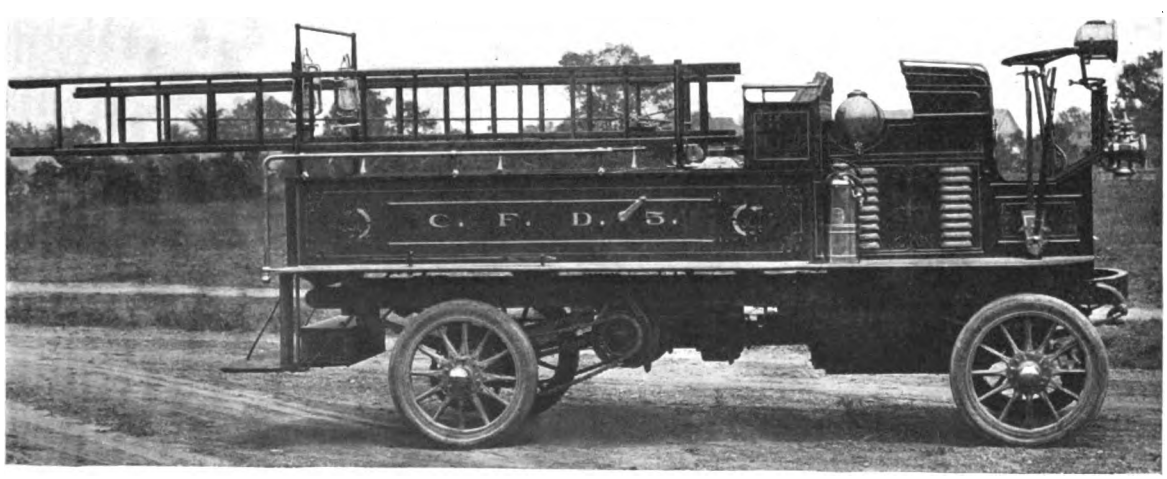
H. H. Franklin Mfg. Co., Syracuse, N. Y.

This firm makes three chasses. The L-1 is a light delivery chassis capable of carrying 1,000 pounds; the L-2 is a heavy de-



Knox combination hose and chemical wagon.

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livery or light truck chassis with a carrying capacity of 2,000 pounds; and the J-3 is of the stake platform type and is built to carry 4,000 pounds. Each of these vehicles is of the type in which the engine is beneath the seat and floor boards, affording opportunity for a short wheel base, which is of value in turning and maneuvering in small spaces. The L-1 and L-2 are practically identical as chasses, the L-2 getting its larger capacity through heavier wheels and heavier supporting construction. The L-1 is lighter and faster in movement, having the same power as the L-2 and carrying about one-half the load. Thirty-two inch wheels are provided on all three types.

The J-3 has a stake patform which has a carrying area of 62½ square feet, the dimensions being 5 feet by 10½ feet. In these trucks a worm drive rear axle is used. The worm and worm wheel are exceptionally large, and the tooth pressures are therefore at the minimum. The J-3 moves normally at the rate of about ten miles an hour and has carried a load of three tons up an eleven per cent grade one-quarter of a mile in length and paved with brick. In all these commercial vehicles full elliptic springs are used in front and semi-elliptic and coil springs at the rear. The rear axle is in such position that it carries two-thirds of the weight. This reduces the work of the front springs. Laminated wood frames are used on all the machines. The 18 hp., air cooled engine is the same in the three vehicles, the bore being 3⅜ inches and the stroke 4 inches. By substantial gear reduction the greater capacity necessary for a big truck is obtained.

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Autocar Equipment Co., Ardmore, Pa.

This firm exhibited an 18-hp. two-cylinder opposed delivery wagon. The frame is of armored wood. Disc clutch and progressive sliding gear set are fitted. The power plant unit consists of engine, clutch and gear set. It may be quickly removed by disconnecting inlet and exhaust water pipes and the three supports. The rear axle construction is quite interesting. A double reduction gearing is used in order to obtain a low speed without the employment of a too small bevel on the back of the drive shaft. A short countershaft is carried in the rear of the axle. It transmits through spur gears to the rear axle. A drum for an external brake is mounted on its end. The front axle is tubular.

* * *

Champion Wagon Co., Owego, New York.

A 1,000-pound electric delivery wagon was shown by this company. It is fitted with a single motor driving a counter-shaft by silent chain. The wheels are 36 inches in diameter. The final drive is by side chains.

General Vehicle Co., Long Island City, N. Y.

Five electric models were shown by this company rated as follows: 3½ tons, 2 tons, one ton, 1,000 pounds and 350 pounds. Structural specifications of these models will be found in the tables of classified manufacture printed elsewhere in this issue. Pressed steel frames are used in all models, as well as silent chain connection between motor and countershaft.

EXHIBITION MODELS SENT BY ROAD.

UNUSUAL interest was manifested in the Knox Company's exhibit at the second New York show when it became known that all of the vehicles comprising it had traveled by road under their own power from the factory at Springfield, Mass., to the Madison Square Garden, a journey of 150 miles.

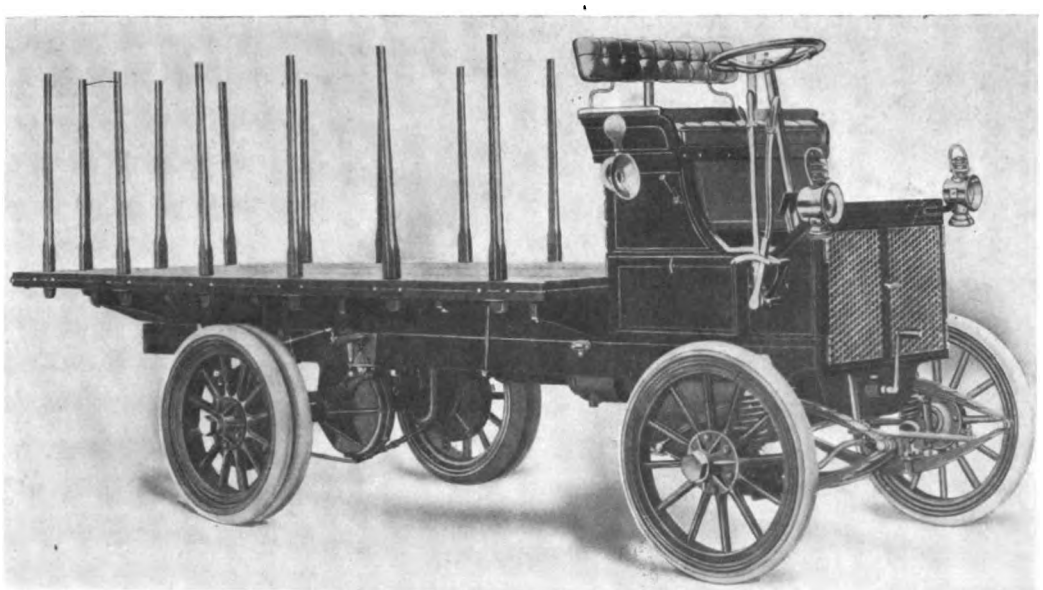
But the novelty of such a journey was not its only remarkable feature. The roads were covered with snow and ice, and the going was very rough. Deep ruts hindered fast travel. All the machines, however, arrived at destination on time, nearly all of them heavily overloaded. The 3,000-pound model carried a 4,800-pound load. The other models averaged about 50 per cent overload throughout the difficult trip.

The business of the Taxi Service Company in Boston has been so prosperous since its start that it has been decided to increase the capital stock from $120,000 to $350,000 and purchase more equipment with the proceeds of the issue.

Three motor stage lines are now running out of San Angelo, Tex., one to Ozona, another to Sterling City and Big Springs, and the third to Sonora.

Motor buses are to be operated between Paoli and New Albany, Ind. Daily service will be furnished.

The Quincy (Ills.) fire department is about to test the efficiency and economy of a motor hose and chemical wagon.



Franklin 2-ton truck.

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Manufacturers of Gasoline Wagons Rated to Carry from 500 to 1,800 Lbs.

Name of Maker—	Price. List	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
*American Motor Truck Co.	$1,500	1,000 lbs.	20 hp.	4 vert.	Water	3 for. 1 rev.	102 in.	56½ in.	Sliding gear	Chain	2	34x3	34x3	36 in.	12 gals.
Atlas Motor Car Co.	1,800	1,500	22 hp.	2 vert.	Water	2 for. 1 rev.	105 in.	56 in.	Sliding gear	Shaft	2	30x4	30x4	25 in.	17 gals.
Auto-Car Equipment Co.	2,000	1,000	24 hp.	4 vert.	Air	3 for. 1 rev.	110 in.	56½ in.	Sliding gear	Chain	2 sets	32x2½	36x3	36 in.	10 gals.
Brush Runabout Co.	500	500	7 hp.	1 vert.	Water	2 for. 1 rev.	75 in.	56 in.	Planetary	Chain	2	.....	.....	27 in.	5 gals.
Cadillac Motor Car Co.	950	1,000	10 hp.	1 horiz.	Water	2 for. 1 rev.	82 in.	56 or 61 in.	Planetary	Chain	1	30x3½	30x3½	36 in.	8 gals.
Chase Motor Truck Co.	750	500	10 hp.	2 vert.	Air	2 for. 1 rev.	84 in.	56 in.	Planetary	Chain	2	38x1¼	40x1¼	36 in.	7 gals.
Chase Motor Truck Co.	900	750	15 hp.	3 vert.	Air	2 for. 1 rev.	94 in.	56 in.	Planetary	Chain	2	38x1⅝	40x1⅝	36 in.	7 gals.
Commercial Motor Truck Co.	1,500	1,200	24 hp.	2 horiz.	Water	.....	84 in.	56 in.	Friction	Chain	2	34x2½	34x3	38 in.	15 gals.
Dowagiac Motor Car Co.	1,500	1,500	18 hp.	2 opp.	Water	2 for. 1 rev.	100 in.	56 in.	Planetary	Chain	..	....	.....	.....	.....
Franklin Mfg. Co.	2,000	1,000	18 hp.	4 vert.	Air	3 for. 1 rev.	83 in.	54 in.	Sliding gear	Worm	2 sets	32x2½	32x3	31 in.	12 gals.
Gaeth Automobile Co.	1,500	1,500	12-15 hp.	1 horiz.	Water	2 for. 1 rev.	103 in.	.....	Planetary	Chain	2	.....	.....	36 in.	12 gals.
Gramm Logan Motor Car Co.	1,600	1,500	25 hp.	4 vert.	Air	2 for. 1 rev.	98 in.	56½ in.	Sliding gear	Chain	4	34x3	34x3	36½ in.	15 gals.
*Hart Kraft Co.	1,050	1,000	14 hp.	dbl.opp.	Water	2 for. 1 rev.	90 in.	56 in.	Planetary	Chain	2	36x2	36x2	32 in.	10 gals.
Hewitt Motor Co.	1,600	1,000	12 hp.	1 vert.	Water	2 for. 1 rev.	84 in.	56 in.	Planetary	Chain	2	32x2½	32x3	36 in.	10 gals.
Holsman Automobile Co.	700	1,000	12 hp.	2 horiz.	Air	2 for. 1 rev.	75 in.	56-62 in.	Cable	Cable	2	.....	.....	29 in.	5½ gals.
*Knox Automobile Co.	1,400	1,500	12 hp.	1 horiz.	Air	2 for. 1 rev.	85 in.	56 in.	Planetary	Chain	3	32x3	36x3	34 in.	15 gals.
Lindsley & Co.	600	1,000	16 hp.	2 horiz.	Air	3 for. 1 rev.	100 in.	48-52 in.	Planetary	Chain	2	36x1½	36x1½	30 in.	8 gals.
Logan Construction Co.	1,750	1,500	20 hp.	4 vert.	Air	2 for. 1 rev.	108 in.	56½ in.	Sliding gear	Chain	4	32x3½	32x3½	36 in.	9 gals.
W. H. McIntyre Co.	800	1,800	18 hp.	2 opp.	Air	2 for. 1 rev.	75 in.	.....	Planetary	Chain	2	38x1½	38x1½	.....	.....
Martin Carriage Works	....	1,000	16 hp.	2 vert.	Water	2 for. 1 rev.	90 in.	56 in.	Planetary	Chain	3	....	.....	34 in.	12 gals.
Olds Motor Works	2,500	1,800	32 hp.	4 vert.	Water	3 for. 1 rev.	120 in.	55 in.	Sliding gear	Shaft	2 sets	34x4½	34x4½	30 in.	15 gals.
*Randolph Motor Car Co.	1,075	1,500	22 hp.	2 horiz.	Water	.....	80 in.	54½ in.	Friction	Chain	2	34x2½	36x3	33 in.	20 gals.
Reliable Dayton Motor Car Co.	1,050	750	20 hp.	2 horiz.	Water	2 for. 1 rev.	91 in.	56 in.	Sliding gear	Chain	2 sets	40x1¾	44x1¾	54 in.	10 gals.
*Sternberg Mfg. Co.	985	1,500	18-20 hp.	2 horiz.	Water	.....	88 in.	56 in.	Friction	Chain	3	36x2	36x2	38 in.	25 gals.
Twyford Motor Car Co. (four wheel drive)	1,500	1,000	18 hp.	2 vert.	Water	3 for. 1 rev.	78 in.	62 in.	Special	Shaft	3	30x2	30x2	.....	10 gals.
Van Wambeke & Sons.	850	1,000	18 hp.	2 vert.	Air	2 for. 1 rev.	80 in.	56 in.	Chain	Chain	2	38x1¼	42x1¼	34 in.	10 gals.

*List price is for chassis only.

Manufacturers of Gasoline Wagons Rated to Carry from 2,000 to 2,500 Lbs.

Name of Maker—	Price. List	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
*American Motor Truck Co.	$2,500	2,000 lbs.	25 hp.	4 vert.	Water	3 for. 1 rev.	108 in.	56½ in.	Sliding gear	Chain	2	36x3½	36x4	40 in.	.....
Autocar Co.	2,225	2,000	18 hp.	2 horiz.	Water	2 for. 1 rev.	97 in.	.....	Sliding gear	Shaft	2	32x3½	32x3½	.....	.....
Auto-Car Equipment Co.	2,500	2,000	25 hp.	4 vert.	Water	3 for. 1 rev.	120 in.	66 in.	Sliding gear	Chain	2 sets	36x3½	36x3½	36 in.	10 gals.
Coppock Motor Car Co.	2,650	2,000	36 hp.	3 vert.	Water	3 for. 1 rev.	87 in.	58 in.	Sliding gear	Chain	4	32x3½	32x4	36 in.	15 gals.
Franklin Mfg. Co.	2,200	2,000	18 hp.	4 vert.	Air	3 for. 1 rev.	83 in.	54 in.	Sliding gear	Worm	2 sets	32x3	32x3½	31 in.	12 gals.
*Knox Automobile Co.	2,200	2,500	20 hp.	2 horiz.	Air	2 for. 1 rev.	97 in.	56 in.	Planetary	Chain	3	32x3½	32x3½	38 in.	18 gals.
Lindsley & Co.	800	2,000	24 hp.	2 horiz.	Water	2 for. 1 rev.	100 in.	48-52 in.	Planetary	Chain	2	36x2	36x2	30 in.	8 gals.
Logan Construction Co.	2,250	2,000	20 hp.	4 vert.	Air	3 for. 1 rev.	96 in.	56½ in.	Sliding gear	Chain	2 sets	32x4	32x4	34 in.	8 gals.
Mitchell Motor Car Co.	2,000	2,000	20 hp.	4 vert.	Water	3 for. 1 rev.	112 in.	56 in.	Sliding gear	Worm	4	30x3	30x3	28 in.	16 gals.
*Sternberg Mfg. Co.	2,000	2,000	26 hp.	2 horiz.	Water	.....	100 in.	56 in.	Friction	Chain	3	34x3	34x3½	36 in.	25 gals.
Wilcox Motor Car Co.	2,250	2,000	30 hp.	4 vert.	Water	3 for. 1 rev.	117 in.	58 in.	Sliding gear	Chain	4	36x3½	36x3½	48 in.	15 gals.

*List price is for chassis only.

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Manufacturers of Gasoline Wagons Rated to Carry from 3000 to 3500 Lbs.

Name of Maker—	Price. List	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
*American Motor Truck	$2,750	3,000	35-40 hp.	4 vert.	Water	3 for. 1 rev.	110 in.	56½ in.	Sliding gear	Chain	2	36x4	36x5	44 in.	.....
Commercial Motor Truck Co	2,250	3,000	40 hp.	4 vert.	Water	.....	103 in.	56 in.	Friction	Chain	2	34x3	36x4	42 in.	16 gals.
Coppock Motor Car Co	2,750	3,000	30-36 hp.	3 vert.	Water	3 for. 1 rev.	90 in.	58 in.	Sliding gear	Chain	4	32x3½	32x3 dual	36 in.	25 gals.
Coppock Motor Car Co	2,850	3,000	30-36 hp.	3 vert.	Water	3 for. 1 rev.	126 in.	58 in.	Sliding gear	Chain	4	32x3½	32x3 dual	36 in.	25 gals.
Gramm Logan Motor Car Co	2,250	3,000	25 hp.	4 vert.	Air	3 for. 1 rev.	96 in.	56½ in.	Sliding gear	Chain	4	34x3½	34x3½	36 in.	15 gals.
*Knox Automobile Co	2,600	3,000	20 hp.	2 horiz.	Air	2 for. 1 rev.	100 in.	56 in.	Planetary	Chain	4	34x3½	34x4	36 in.	18 gals.
Oscar Lear Automobile Co	2,750	3,000	24 hp.	4 vert.	Blower	3 for. 1 rev.	120 in.	66 in.	Sliding gear	Chain	3	36x4	36x3½ dual	38 in.	16 gals.
*Randolph Motor Car Co	2,000	3,000	30 hp.	4 vert.	Water	3 for. 1 rev.	100 in.	56 in.	Sliding gear	Chain	3	36x4	38x5	44 in.	25 gals.
Speedwell Motor Car Co	2,500	3,500	24 hp.	4 vert.	Water	3 for. 1 rev.	120 in.	56 in.	Sliding gear	Shaft	4	34x5	34x5	39 in.	24 gals.
Sayers & Scovill Co	2,500	3,000	20-24 hp.	4 vert.	Air	3 for. 1 rev.	100 in.	60 in.	Sliding gear	Chain	2 sets	32x3½	34x3½	36 in.	10 gals.

*List price is for chassis only.

Manufacturers of Gasoline Wagons Rated to Carry 4,000 Lbs.

Name of Maker—	Price. List	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
*American Motor Truck Co	$3,000	4,000	40 hp.	4 vert.	Water	3 for. 1 rev.	112 in	56½ or 61 in.	Sliding gear	Chain	2	36x4	36x3 dual	44 in.	.....
Carlson Motor Truck Co	3,000	4,000	30 hp.	4 horiz.	Water	2 for. 1 rev.	96 in.	64 in.	Planetary	Chain	5	....	....	42 in.	20 gals.
Coppock Motor Car Co	2,850	4,000	36 hp.	3 vert.	Water	3 for. 1 rev.	126 in.	60 in.	Sliding gear	Chain	4	32x4	32x3½ dual	36 in.	25 gals
Franklin Mfg. Co	2,500	4,000	18 hp.	4 vert.	Air	3 for. 1 rev.	100 in.	56 in.	Sliding gear	Worm	2 sets	32x3	32x3 dual	40 in.	12 gals.
Hewitt Motor Co	3,000	4,000	24 hp.	2 horiz.	Water	2 for. 1 rev.	109 in.	60 in.	Planetary	Chain	2	34x4	34x7 dual	38 in.	15 gals.
*Knox Automobile Co	3,500	4,000	40 hp.	4 vert.	Air	3 for. 1 rev.	125 in.	60¾ in.	Sliding gear	Chain	4	36x4	36x5	44 in.	20 gals.
*Mack Bros. Motor Car Co	3,500	4,000	50 hp.	4 vert.	Water	3 for. 1 rev.	126 in.	68 in.	Indvl. clutch	Chain	4	36x4	36x3 dual	.....	22 gals.
Reliance Motor Truck Co	....	4,000	30 hp.	2 vert.	Water	3 for. 1 rev.	105 in.	57 in.	Sliding gear	Chain	2	32x4	32x4	40 in.	20 gals.
Wilcox Motor Car Co	2,750	4,000	30 hp.	4 vert.	Water	3 for. 1 rev.	126 in.	58 in.	Sliding gear	Chain	4	36x3½	36x2¾ dual	48 in.	15 gals.

*List price is for chassis only.

Manufacturers of Gasoline Wagons Rated to Carry 5,000 Lbs.

Name of Maker—	List Price.	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
Commercial Motor Truck Co	$2,500	5,000 lbs.	50 hp.	4 vert.	Water	.....	108 in.	56 in.	Friction	Chain	2	34x3½	36x3 dual	42 in.	16 gals.
Oscar Lear Automobile Co	3,000	5,000 lbs.	24 hp.	4 vert.	Blower	4 for. 1 rev.	128 in.	66 in.	Sliding gear	Chain	3	36x4	36x3½ dual	42 in.	16 gals.

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Manufacturers of Gasoline Wagons Rated to Carry 6,000 Lbs.

Name of Maker—	Price. List	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
American Machine Mfg. Co.	$3,000	6,000 lbs.	35 hp.	4 vert.	Water	3 for. 1 rev.	108 in.	.....	Sliding gear	Chain	2 sets	32x4	36x5 dual	40 in.	15 gals.
*American Motor Truck Co.	3,500	6,000	55 hp.	4 vert.	Water	2 for. 1 rev.	118 in.	61 in.	Planetary	Chain	2	36x5	36x4 dual	44 in.	20 gals.
Auto-Car Equipment Co.	3,500	6,000	40 hp.	4 vert.	Water	3 for. 1 rev.	.....	62 in.	Sliding gear	Chain	2 sets	36x4	36x5	39 in.	15 gals.
Chase Motor Truck Co.	3,500	6,000	30 hp.	4 vert.	Air	3 for. 1 rev.	125 in.	56 in.	Sliding gear	Chain	2	36x4	36x3 dual	48 in.	20 gals.
Fairbanks, Morse & Co.	3,850	6,000	32 hp.	4 vert.	Water	3 for. 1 rev.	108 in.	78 in.	Jaw clutch	Chain	2	36x5	36x4½ dual	40 in.	20 gals.
Gramm Logan Motor Car Co.	3,500	6,000	45 hp.	4 vert.	Water	3 for. 1 rev.	120 in.	60 in.	Sliding gear	Chain	4	36x5	36x3½ dual	36 in.	18 gals.
*Knox Automobile Co.	3,750	6,000	40 hp.	4 vert.	Air	3 for. 1 rev.	125 in.	67 in.	Sliding gear	Chain	4	36x4	36x3½ dual	44 in.	20 gals.
Logan Construction Co.	3,500	6,000	40 hp.	4 vert.	Water	3 for. 1 rev.	120 in.	60 in.	Sliding gear	Chain	2 sets	36x5	36x3½ dual	42 in	15 gals.
*Mack Bros. Motor Car Co.	4,000	6,000	50 hp.	4 vert.	Water	3 for. 1 rev.	126 in.	68 in.	Indvl. clutch	Chain	4	36x5	36x3½ dual	.....	22 gals.
Parr Wagon Co.	3,500	6,000	40 hp.	4 vert.	Water	.....	111 in.	60 in.	Friction	Chain	2 sets	34x4	36x3½ dual	45 in.	17 gals.
Packard Motor Car Co.	3,850	6,000	24 hp.	4 vert.	Water	3 for. 1 rev.	144 in.	68 in.	Sliding gear	Chain	4	34x4	34x4 dual	42½ in.	22 gals.
*Randolph Motor Car Co.	3,500	6,000	45 hp.	4 vert.	Water	3 for. 1 rev.	124 in.	58 in.	Sliding gear	Chain	3	36x6	36x6 dual	46 in.	30 gals.
Reliance Motor Truck Co.	3,500	6,000	45 hp.	3 vert.	Water	3 for. 1 rev.	131 in.	62 in.	Sliding gear	Chain	2	36x5	36x3½ dual	48 in.	20 gals.
Sayers & Scovill Co.	3,500	6,000	40-45 hp.	4 vert.	Water	3 for. 1 rev.	146 in.	68 in.	Sliding gear	Chain	3 sets	36x4	36x4 dual	36 in.	20 gals.
*Sternberg Motor Car Co.	3,000	6,000	40-45 hp.	4 vert.	Water	3 for. 1 rev.	120 in.	60 in.	Cotta type	Chain	2 sets	36x5	36x3½ dual	42 in.	30 gals.
Wilcox Motor Car Co.	3,000	6,000	30 hp.	4 vert.	Water	3 for. 1 rev.	126 in.	58 in.	Sliding gear	Chain	4	36x4	36x3 dual	48 in.	15 gals.

*List price is for chassis only.

Manufacturers of Gasoline Wagons Rated to Carry 8,000 Lbs.

Name of Maker—	List Price.	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
Alden Sampson Mfg. Co.	$4,500	8,000 lbs.	40 hp.	4 vert.	Water	4 for. 1 rev.	145 in.	68 in.	Sliding gear	Chain	3	36x4½	36x4 dual	42 in.	25 gals.
Commercial Motor Car Co.	5,000	8,000	30-40 hp.	4 vert.	Water	3 for. 1 rev.	153 in.	64 in.	Sliding gear	Chain	3	36x4	42x4 dual	30-42 in.	25 gals.
*Knox Automobile Co.	4,000	8,000	50-60 hp.	4 vert.	Water	3 for. 1 rev.	149 in.	67 in.	Sliding gear	Chain	4	36x4	36x4 dual	44 in.	20 gals.
*Mack Bros. Motor Car Co.	4,250	8,000	50 hp.	4 vert.	Water	3 for. 1 rev.	126 in.	68 in. front 72 in. rear	Indvl. clutch	Chain	4	36x5	36x3½ dual	.....	22 gals.

*List price is for chassis only.

Manufacturers of Gasoline Wagons Rated to Carry 10,000 Lbs.

Name of Maker—	Price. List	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
American Machine Mfg. Co.	$5,000	10,000 lbs.	60 hp.	4 vert.	Water	3 for. 1 rev.	140 in.	.....	Sliding gear	Chain	2 sets	32x5	36x6 dual	40 in.	25 gals.
*American Motor Truck Co.	4,250	10,000	65 hp.	4 vert.	Water	2 for. 1 rev.	130 in.	61 in.	Planetary	Chain	2 sets	36x7	36x5 dual	44 in.	20 gals.
Auto-Car Equipment Co.	4,500	10,000	60 hp.	4 vert.	Water	3 for. 1 rev.	130 in.	62 or 70 in.	Sliding gear	Chain	2 sets	36x5	36x7	42 in.	15 gals.
*Hewitt Motor Co.	4,500	10,000	30 hp.	4 vert.	Water	2 for. 1 rev.	138 in.	66 in.	Planetary	Chain	2	36x4 dual	36x5 dual	44 in.	27 gals.
*Knox Automobile Co.	4,300	10,000	60 hp.	4 vert.	Water	3 for. 1 rev.	149 in.	67 in.	Sliding gear	Chain	4	36x5	36x4 dual	44 in.	20 gals.
*Mack Bros. Motor Car Co.	4,800	10,000	50 hp.	4 vert.	Water	3 for. 1 rev.	126 in.	68 in. front 72 in. rear	Indvl. clutch	Chain	4	36x5	36x3½ dual	.....	22 gals.
*Mack Bros. Motor Car Co. (Dumping Truck)	6,000	10,000	50 hp.	4 vert.	Water	3 for. 1 rev.	126 in.	68 in. front 72 in. rear	Indvl. clutch	Chain	4	36x6	36x4 dual	.....	22 gals.
Ralph L. Morgan	....	10.000	45 hp.	4 vert.	Water	2 for. 1 rev.	108 in.	60 in.	Planetary	Chain	3	36x5	36x4 dual	.....	25 gals.
Reliance Motor Truck Co.	4,400	10,000	60 hp.	4 vert.	Water	3 for. 1 rev.	131 in.	64 in.	Sliding gear	Chain	2	36x5	36x3½ dual	48 in.	20 gals.

*List price is for chassis only.

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Manufacturers of Gasoline Motor Cabs.

Name of Maker—	Price. List	Passenger Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	No. of Brakes.	Size of Front Tires.	Size of Rear Tires.	Type of Clutch.	Extreme Length Over All.	Fuel Tank Capacity.
American Locomotive Co.	$3,350	5	16 hp.	4 vert.	Water	3 for. 1 rev.	103 in.	56 in.	Sliding gear	Shaft	2 sets	32x4	32x4	Disc	144 in.	12 gals.
Apperson Bros. Auto. Co.	3,000	5	30 hp.	4 vert.	Water	3 for. 1 rev.	119 in.	56 in.	Sliding gear	Shaft	2 sets	34x4	34x4	Contract'g	166 in.	15 gals.
Atlas Motor Car Co.	2,500	5	22 hp.	2 vert.	Water	3 for. 1 rev.	100 in.	56 in.	Sliding gear	Shaft	3	30x4	30x4	Disc	144 in.	18 gals.
Bristol Engineering Co.	3,300	5	20 hp.	4 vert.	Water	3 for. 1 rev.	106 in.	53 in.	Sliding gear	Shaft	2 sets	32x4	32x4	Disc	138 in.	.....
Cleveland Taxicab Co.	....	4	20 hp.	4 vert.	Water	3 for. 1 rev.	106 in.	54 in.	Sliding gear	Shaft	3	32x4	32x4	Disc	156 in.	15 gals.
Elmore Mfg. Co.	2,250	4	24 hp.	3 vert.	Water	3 for. 1 rev.	104 in.	56 in.	Sliding gear	Shaft	4	34x4	34x4	Expand'g	147 in.	15 gals.
Ford Motor Co.	950	5	20 hp.	4 vert.	Water	2 for 1 rev.	100 in.	56 in.	Planetary	Shaft	3	30x3½	30x3½	Disc	140 in.	10 gals.
Knox Automobile Co.	3,000	5	30 hp.	4 vert.	Air	3 for. 1 rev.	102 in.	56 in.	Sliding gear	Shaft	3	32x4	32x4	Cone	126 in.	16 gals.
Knox Automobile Co.	3,250	5	38 hp.	4 vert.	Water	3 for. 1 rev.	102 in.	56 in.	Sliding gear	Shaft	3	32x4	32x4	Cone	134 in.	16 gals.
Sultan Motor Co.	3,000	5	12 hp.	4 vert.	Water	3 for. 1 rev.	98½ in	53 in.	Sliding gear	Shaft	3	32x4	32x4	Disc	.....	12 gals.
Thomas Motor Car Co.	3,000	6	20 hp.	4 vert.	Water	3 for. 1 rev.	103 in.	56 in.	Sliding gear	Shaft	2 sets	32x4	32x4	Disc	150 in.	12 gals.

Manufacturers of Gasoline Motor Buses.

Name of Maker—	Price. List	Passenger Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Method of Transmission.	Drive to Road Wheels.	No. of Brakes.	Size of Front Tires.	Size of Rear Tires.	Type of Clutch.
American Machine Mfg. Co.	$3,500	30	35 hp.	4 vert.	Water	3 for. 1 rev.	111 in.	56 in.	Sliding gear	Chain	2	34x4	36x5	.....
American Motor Truck Co.	2,750	14	40 hp.	4 vert.	Water	3 for. 1 rev.	112 in.	56½-61 in.	Sliding gear	Chain	2	36x3½	36x4	Cone
*Autocar Company	2,000	12	18 hp.	2 horiz.	Water	3 for. 1 rev.	85-97 in.	56 in.	Sliding gear	Shaft	3	32x3½	32x3½	Floating ring
Auto-Car Equipment Co.	3,500	14	40 hp.	4 vert.	Water	4 for. 1 rev.	120 in.	62 in.	Sliding gear	Chain	4 sets	36x3½	36x4	Cone.
*Carlson Motor Truck Co.	3,000	16	24 hp.	4 horiz.	Water	3 for. 1 rev.	108 in.	64 in.	Planetary	Chain	4	.....	.....	Disc
Carlson Motor Truck Co.	3,250	20	30 hp.	4 horiz.	Water	2 for. 1 rev.	108 in.	64 in.	Planetary	Chain	5	.....	.....	Disc
*Chase Motor Truck Co.	900	8	15 hp.	3 vert.	Air	2 for. 1 rev.	90 in.	56 in.	Planetary	Chain	2	38x1⅝	38x1⅝	Disc
Commercial Motor Truck Co.	2,600	16	40 hp.	4 vert.	Water	.....	128 in.	56 in.	Friction	Chain	2	34x3	36x4	.....
Coppock Motor Car Co.	4,000	12	30 hp.	3 vert.	Water	3 for. 1 rev.	126 in.	58 in.	Sliding gear	Chain	4	32x3½	32x3 dual	Cone
Grabowsky Power Wagon Co.	2,600	12	35 hp.	4 horiz.	Water	2 for. 1 rev.	102 in.	56 in.	Planetary	Chain	3	32x3½	32x3½	Cone
Grabowsky Power Wagon Co.	2,750	16	35 hp.	4 horiz.	Water	2 for. 1 rev.	102 in.	56 in.	Planetary	Chain	3	32x3½	32x3½	Cone
Grabowsky Power Wagon Co.	3,050	20	35 hp.	4 horiz.	Water	2 for. 1 rev.	127 in.	56 in.	Planetary	Chain	3	32x4	34x4	Cone
Grabowsky Power Wagon Co.	3,750	25	35 hp.	4 horiz.	Water	2 for. 1 rev.	127 in.	56 in.	Planetary	Chain	3	32x5	34x5	Cone
Gramm Logan Motor Car Co.	3,500	30	40 hp.	4 vert.	Water	3 for. 1 rev.	120 in.	60 in.	Sliding gear	Chain	4	36x5	36x3½ dual	Disc
Gramm Logan Motor Car Co.	2,250	20	25 hp.	4 vert.	Air	3 for. 1 rev.	98 in.	56½ in.	Sliding gear	Chain	4	34x3½	34x3½	Disc
*Hewitt Motor Co.	2,750	16	24 hp.	2 horiz.	Water	2 for. 1 rev.	109 in.	60 in.	Planetary	Chain	2	34x4	34x7 dual	Cone
Oscar Lear Automobile Co.	3,300	18	24 hp.	4 vert.	Blower	4 for. 1 rev.	128 in.	66 in.	Sliding gear	Chain	3	.....	.....	Cone
J. V. Lindsley Co.	620	9	18 hp.	2 opp.	Air	2 for. 1 rev.	96 in.	56-62 in.	Planetary	Chain	2	.....	.....	.....
Mack Bros. Motor Car Co.	5,500	12	50-hp.	4 vert.	Water	3 for. 1 rev.	138 in.	66 in.	Ind. clutch	Chain	4	36x4	36x3 dual	Cone
Mack Bros. Motor Car Co.	4,800	12	50 hp.	4 vert.	Water	3 for. 1 rev.	122 in.	66 in.	Ind. clutch	Chain	4	36x4	36x3 dual	Cone
Mack Bros. Motor Car Co.	5,000	16	50 hp.	4 vert.	Water	3 for. 1 rev.	122 in.	59 in.	Ind. clutch	Chain	4	36x4½	36x3 dual	Cone
Mack Bros. Motor Car Co.	5,500	16	50 hp.	4 vert.	Water	3 for. 1 rev.	132 in.	68 in.	Ind. clutch	Chain	4	36x5	36x3½ dual	Cone
Mack Bros. Motor Car Co.	5,000	20	50 hp.	4 vert.	Water	3 for. 1 rev.	148-154 in.	68 in.	Ind. clutch	Chain	4	36x4½	36x3½ dual	Cone
Mack Bros. Motor Car Co.	6,500	22	50 hp.	4 vert.	Water	3 for. 1 rev.	162 in.	68 in. front 72 in. rear.	Ind. clutch	Chain	4	36x6	36x4 dual	Cone
Rapid Motor Vehicle Co.	....	12-20	24-30 hp.	2 opp.	Water	3 for. 1 rev.	100-111 in.	56 in.	Planetary	Chain	4	3½ in.	4 in.	Disc
Knox Automobile Co.	3,200	14	20 hp.	2 horiz.	Air	2 for. 1 rev.	97 in.	56 in.	Planetary	Chain	3	32x3½	32x3½	.....
Knox Automobile Co.	3,200	19	20 hp.	2 horiz.	Air	2 for. 1 rev.	100 in.	56 in. front 58 in. rear	Planetary	Chain	3	34x3½	34x4	.....

*List price is for chassis only.

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Manufacturers of Electric Wagons Rated to Carry From 350 to 2000 Lbs.

Name of Maker—	List Price.	Normal Load Capacity.	Normal Road Speed.	No. of Motors.	No. of Battery Cells.	Mileage on Single Charge.	Drive to Road Wheels.	Standard Wheel Base.	Track or Gauge.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Special Features.
Baker Motor Vehicle Co.	$2,600	2,000 lbs.	11 M.P.H.	1	42	40-60	Chain	92 in.	56 in.	34x3½	34x3½	34 in.	Quick detachable battery cradle.
Champion Wagon Co.	2,500	2,000 lbs.	10½ M.P.H.	1	44	40	Chain	90 in.	58 in.	34x3½	34x3½	30 in.	
Commerc'l Motor Truck Co. of America	2,500	1,000 lbs.	15 M.P.H.	1	40	60	Spiral	90 in.	56½ in.	36x3	40x3	36 in.	
Commerc'l Motor Truck Co. of America	3,000	2,000 lbs.	12 M.P.H.	1	40	60	Spiral	100 in.	62 in.	34x3½	36x4	34 in.	
Couple Gear Freight Wheel Co.	2,400	2,000 lbs.	9 M.P.H.	2	40	40	Couple gear	82 in.	56 in.	36x3½	36x3 steel	32 in.	Front wheel drive
Couple Gear Freight Wheel Co.	2,500	2,000 lbs.	9 M.P.H.	2	40	40	Couple gear	82 in.	56 in.	36x3½	36x3½ rub.	42 in.	Front wheel drive
General Vehicle Co.	1,800	350 lbs.	14 M.P.H.	1	44	50	Chain	70 in.	50 in.	30x2	30x2	43 in.	
General Vehicle Co.	2,200	1,000 lbs.	11 M.P. H.	1	44	40	Chain	83½ in.	55 in.	32x2½	32x2½	60 in.	
General Vehicle Co.	2,650	2,000 lbs.	10 M.P.H.	1	44	40	Chain	102 in.	60 in.	32x3½	32x3½	60 in.	
Pittsburg Motor Vehicle Co.	1,800	750 lbs.	11 M.P.H.	1	22	40	Chain	75 in.	54 in.	32x2½	34x2½	35 in.	
Pittsburg Motor Vehicle Co.	2,400	1,500 lbs.	9 M.P.H.	2	42	40	Chain	96 in.	64 in.	34x3½	34x3½	38 in.	
Studebaker Automobile Co.	....	800 lbs.	11¼ M.P.H.	1	24	30	Chain	84 in.	59 in.	36x2½	42x2½	34 in.	
Studebaker Automobile Co.	....	1,500 lbs.	11 M.P.H.	2	44	35	Chain	91 in.	56 in.	36x3	42x3	36 in.	
Waverley Co.	1,500	800 lbs.	14 M.P.H.	1	40	40	Gear	85 in.	54 in.	30x4	30x4	31 in.	
Waverley Co.	1,800	1,200 lbs.	12 M.P.H.	1	42	35	Chain	91 in.	60 in.	32x3	36x3	36 in.	
Waverley Co.	2,250	2,000 lbs.	9 M.P.H.	2	42	30	Chain	92 in.	67 in.	36x3	36x3	40 in.	
Lansden Co.	2,450	1,000 lbs.	12 M.P.H.	1	60	45	Chain	88 in.	56 in.	32x2½	32x2½	31 in.	
Lansden Co.	2,450	2,000 lbs.	10 M.P.H.	1	60	35	Chain	88 in.	56 in.	32x3	32x3	31 in.	
Lansden Co.	3,050	2,000 lbs.	10 M.P.H.	1	60	50	Chain	88 in.	56 in.	32x3	32x3	31 in.	

Manufacturers of Electric Wagons Rated to Carry From 2,500 to 4,000 Lbs.

Name of Maker—	List Price.	Normal Load Capacity.	Normal Road Speed.	No. of Motors.	No. of Battery Cells.	Mileage on Single Charge.	Drive to Road Wheels.	Standard Wheel Base.	Track or Gauge.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Special Features.
Commercial Truck Co. of America	$3,500	4,000 lbs.	10 M.P.H.	2	42	40	Spur gear	.....	.....	.....	.....	40 in.	
Couple Gear Freight Wheel Co.	3,075	4,000 lbs.	8 M.P.H.	2	42	35	Couple gear	96 in.	56 in.	36x5	36x3½ steel	42 in.	Front wheel drive
Couple Gear Freight Wheel Co.	3,200	4,000 lbs.	7½ M.P.H.	2	42	35	Couple gear	96 in.	56 in.	36x5	36x5 rub.	42 in.	Front wheel drive
Couple Gear Freight Wheel Co.	3,800	4,000 lbs.	10 M.P.H.	4	44	35	Couple gear	96 in.	56 in.	36x5	36x5 rub.	42 in.	Four wheel drive
General Vehicle Co.	3,400	4,000 lbs.	8½ M.P.H.	1	44	40	Chain	111½ in.	61 in.	36x4	36x2½ d'l	42 in.	
Lansden Company	3,600	4,000 lbs.	8 M.P.H.	1	60	35	Chain	100-112 in.	66 in.	32x4	32x4	35 in.	
Pittsburg Motor Vehicle Co.	2,900	3,000 lbs.	8 M.P.H.	2	42	35	Chain	108 in.	64 in.	34x4	34x4	37 in.	
Studebaker Automobile Co.	....	2,500 lbs.	9½ M.P.H.	2	44	35	Chain	104 in.	58½ in.	36x4	42x4	38 in.	
Studebaker Automobile Co.	....	4,000 lbs.	9¼ M.P.H.	2	44	35	Chain	117 in.	61 in.	36x5	36x3½ d'l	38 in.	
Waverley Company	3,250	4,000 lbs.	8 M.P.H.	2	42	25	Chain	111 in.	73 in.	36x4	36x4	42 in.	

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Manufacturers of Electric Wagons Rated to Carry From 4500 to 8000 Lbs.

Name of Maker—	List Price.	Normal Load Capacity.	Normal Road Speed.	No. of Motors.	No. of Battery Cells.	Mileage on Single Charge.	Drive to Road Wheels.	Standard Wheel Base.	Track or Gauge.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Special Features.
Auto-Car Equipment Co.	$3,500	6,000 lbs.	10 M.P.H.	2	42	40	Chain	95 in.	60 in.	36x4	36x5 dual	42 in.	
Commercial Truck Co. of America	4,000	7,000 lbs.	9 M.P.H.	4	42	30	Spur gear	114 in.	76½ in.	36x3½ d'l	36x3½ d'l	41 in.	Four wheel drive
Couple-Gear Freight-Wheel Co.	4,400	7,000 lbs.	10 M.P.H.	4	44	35	Couple gear	102 in.	66 in.	36x3½ d'l	36x3½ d'l	42 in.	Four wheel drive
General Vehicle Co.	4,000	7,000 lbs.	7 M.P.H.	1	44	35	Chain	125 in.	65 in.	36x6	36x3½ d'l	40½ in.	
Pittsburg Motor Vehicle Co.	3,400	6,000 lbs.	7 M.P.H.	2	42	35	Chain	120 in.	64 in.	34x5	34x5	36 in.	
Studebaker Automobile Co.	....	7,000 lbs.	9 M.P.H.	2	44	30	Chain	127 in.	75 in.	36x5	36x4 dual	40 in.	
Waverley Company	3,750	6,000 lbs.	7 M.P.H.	2	42	25	Chain	118 in.	73 in.	36x5	36x5	43 in.	

Manufacturers of Electric Wagons Rated to Carry 10,000 Lbs. and Over.

Name of Maker—	List Price.	Normal Load Capacity.	Normal Road Speed.	No. of Motors.	No. of Battery Cells.	Mileage on Single Charge.	Drive to Road Wheels.	Standard Wheel Base.	Track or Gauge.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Special Features.
Auto-Car Equipment Co.	$4,500	12,000 lbs.	6 M.P.H.	2	42	35	Chain	100 in.	72 in.	36x6	36x7	48 in.	
Commercial Truck Co. of America	4,500	10,000 lbs.	5½ M.P.H.	4	42	25	Spur gear	132 in.	79½ in.	36x4 dual	36x4 dual	41 in.	Four wheel drive
Couple Gear Freight Wheel Co.	5,000	10,000 lbs.	5 M.P.H.	4	44	25	Couple gear	102 in.	72 in.	36x4 dual	36x4 dual	42 in.	Four wheel drive
General Vehicle Co.	4,500	10,000 lbs.	6 M.P.H.	1	44	30	Chain	142 in.	66½ in.	36x7	36x4 dual	41½ in.	
Studebaker Automobile Co.	....	10,000 lbs.	6¼ M.P.H.	2	44	..	Chain	126 in.	75 in.	36x7	36x4 dual	42 in.	

Manufacturers of Electric Buses.

Name of Maker—	List Price.	Passenger Capacity.	Normal Road Speed.	No. of Motors.	No. of Battery Cells.	Mileage on Single Charge.	Drive to Road Wheels.	Standard Wheel Base.	Track or Gauge.	Size of Front Tires.	Size of Rear Tires.	Extreme Length Over All.
Auto-Car Equipment Co.	$3,500	14	15 M.P.H.	2	42	40	Chain	100 in.	62 in.	36x3½	36x4	154 in.
Baker Motor Vehicle Co.	3,000	12	12 M.P.H.	1	42	40-60	Chain	92 in.	56 in.	34x3½	34x3½	136 in.
Com'l Truck Co. of Am.	5,500	34	12 M.P.H.	4	42	30	Spur g'r	144 in.	.....	36x4 dual	36x4 dual	252 in.
Pittsb'g Motor Vehicle Co.	2,400	12	12 M.P.H.	2	42	35	Chain	96 in.	64 in.	34x3½	34x3½	140 in.
Pittsb'g Motor Vehicle Co.	2,900	25	10 M.P.H.	2	42	35	Chain	108 in.	64 in.	36x4	36x4	154 in.
Waverley Company	3,250	10	12 M.P.H.	1	42	35	Chain	91 in.	60 in.	32x3	36x3	128 in.

Manufacturers of Gasoline-Electric Trucks Rated to Carry from 4,000 to 10,000 Lbs.

Name of Maker—	List Price.	Normal Load Capacity.	Engine Rating.	No. and Position of Cyls.	Engine Cooling Method.	No. of Motors.	No. of Speeds.	Standard Wheel Base.	Track or Gauge.	Drive to Road Wheels.	Number of Brakes.	Size of Front Tires.	Size of Rear Tires.	Platform Height.	Fuel Tank Capacity.
Couple Gear Freight Wheel Co.	$3,375	4,000 lbs.	25 hp.	4 vert.	Water.	2	8	96 in.	56 in.	Couple gear	2	5 in.	3½ in. steel	42 in.	10 gals.
Couple Gear Freight Wheel Co.	3,500	4,000	25 hp.	4 vert.	Water	2	8	96 in.	56 in.	Couple gear	2	5 in.	5 in. rub.	42 in.	10 gals.
Couple Gear Freight Wheel Co.	4,100	4,000	25 hp.	4 vert.	Water	4	8	96 in.	56 in.	Couple gear	4	5 in.	5 in. rub.	42 in.	10 gals.
Couple Gear Freight Wheel Co.	4,800	7,000	35 hp.	4 vert.	Water	4	8	102 in.	66 in.	Couple gear	4	7 in.	7 in. rub.	42 in.	10 gals.
Couple Gear Freight Wheel Co.	5,500	10,000	45 hp.	4 vert.	Water	4	8	102 in.	72 in.	Couple gear	4	8 in.	8 in. rub.	42 in.	15 gals.

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HARD TEST FOR TIRES.

EQUIPPED with Goodyear hard rubber base tires, a Rapid machine recently accomplished the longest winter journey ever undertaken by a commercial motor vehicle. A ten-day trip from Pontiac to New York ended on December 30. Ice, snow, frozen and sharp ridges, sand and mud were encountered on the way. The tires perfectly withstood the test of these conditions.

The remarkably tough tread did not suffer a single severe cut from contact with the knife-edged pieces of broken ice encountered during much of the trip. The firm vulcanization of this thick and resilient tread to the hard rubber base, which contains the retaining wires, making the whole practically one piece, proved that the tire will do all the Goodyear company claims for it in the matter of clinging to its fastenings under the severest possible strains. The metal cleats, too, were a positive safeguard against the creeping of the tires, and the method of locking the rubber to the rim so well withstood the wrenching in the rough roads that the driver had not a single instance to report of a tire coming off or even working loose.

The truck arrived in Cleveland the 21st. The roads between Cleveland and Buffalo were almost impassable, and the machine did not reach the latter point until the 23d. The driver found it necessary to make this part of the journey very slowly in order to avoid serious accident. The tires protected the rims so well that the latter were not chipped or splintered. More bad roads were encountered between Buffalo and Syracuse.

FIRESTONE TIRES IN LOS ANGELES.

ANOTHER branch house has been opened by the Firestone Tire & Rubber Company at Los Angeles. The management is in the hands of G. C. Calbetzor, formerly Pacific coast representative, and Frank R. Talbott, who resigned as assistant treasurer of the company and left Akron the last of January to assume the duties of his new position. The new establishment will distribute Firestone tires throughout Southern California.

Motor buses running between Pinedale and Rock Springs, Wyo., make the journey in six hours. Horse-drawn coaches required two days for the trip. The distance between the two points is 117 miles.

A late type of tractor, which has made its appearance abroad, is fitted with a 50 hp. engine. All four wheels are driven and steered.

It is now possible to get manufacturers to contract for the maintenance of London motor bus tires at a charge of 3¼ cents a mile.

Arrangements have been completed for the operation of motor cabs in Wilkesbarre, Pa.

New Bedford, Mass., is now being supplied with motor cab service.

WILL CONTINUE "PLYMOUTH" MANUFACTURE.

ABOUT a month ago the Commercial Motor Truck Company, of Plymouth, Ohio, was thrown into bankruptcy. On January 11, the entire property was purchased by certain parties representing another company of the same name formed to take over the entire business of the bankrupt establishment. The manufacture of Plyouth commercial motor vehicles will therefore be continued without interruption.

H. H. Fate, president of the old company, is also at the head of the new concern, while W. C. Guilder, formerly manager of the old concern, will be the new company's vice-president and general manager. The newly organized company will make two new models in addition to those which have heretofore been produced in the factory. One of the new machines will be rated to carry between three and four tons. The other will have a maximum capacity of 800 pounds. The remaining models are rated to carry between 1,000 and 5,000 pounds. The double variable speed transmission, which has been a characteristic of all Plymouth models, will be preserved. The factory has at the present moment sufficient orders on hand to keep it busy for the next three months.

NEW PATTERN OF STORAGE BATTERY.

SOME owners of electrical vehicles require greater mileage per charge than is normally obtainable from the batteries commonly found in the market. To meet this condition the Electric Storage Battery Company, of Philadelphia, is making the Hycap-Exide battery, the design of which and its essential details are similar to the Exide battery, except that the plates of the former are thinner, which permits the use of a larger number in the same space and for about the same weight as the Exide, thus giving a greater capacity for a given weight and space, although the capacity per plate is less.

In a service calling for full mileage from a Hycap-Exide battery on each charge the total mileage obtainable during life is about the same as that obtained from the Exide.

To facilitate the collection of mail in Newton, Mass., and the neighborhood the service of one automobile will be obtained. The machine will cover 110 miles daily, serving Auburndale, Newton, Newton Center, Newton Highlands, Lower Falls, Upper Falls, Newtonville, Waban and West Newton, with a total area of 20 square miles.

A truck farmer living on the edge of Evanston, Ill., has bought a motor wagon to haul his produce to market.

The manufacture of motor hearses is now being regularly undertaken by a Rochester company which for many years has specialized the making of horse drawn hearses.

A motor driven police patrol wagon has been purchased for the city of Richmond, Va.

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THE HIRING OUT OF ARMY VEHICLES.

FOR some reason or other as yet undiscovered the German war department have decided to hire out its motor wagons to individuals and firms which express a desire to learn something of motor wagon transportation by practical service employment of the machines. The terms upon which these military motors may be obtained are as follows:

1. Vehicles are to be manned exclusively by soldiers attached to the experimental section of the transport department.

2. Vehicles may not be hired for transporting goods within the metropolitan area, or such goods as are calculated to bring the army into disrespect.

3. Vehicles are lent at hirer's risk. The war office accepts no responsibility for damages or injuries occuring to goods or persons in the vehicles used.

4. No expenses shall be incurred by the war office through the letting out of the vehicles. All costs must be borne by the hirer.

5. As the letting out of automobiles owned by the war office is possible only to a limited extent and for a short time, it is advisable that, in the first place, application for hire should be made to one of the firms whose makes have already been declared to be entitled to the subvention.

Further than this, the non-commissioned officer in charge of each vehicle is to be paid by the hirer at the rate of 36 cents a day, the military driver receiving 24 cents a day and an attendant 18 cents a day. At the end of each demonstration the vehicle loaned is to be returned to the army authorities in good condition of repair. It is also necessary for hirers to insure the vehicles temporarily in their care against loss by fire and accident. Applicants must state the nature of the service to be demonstrated, the loads to be hauled, the condition of the roads and the bearing capacity of bridges to be traversed.

Motor buses are operating between Needles and Parker, Calif.

TO MAKE AGRICULTURAL MACHINES.

A COMPANY, with capital stock of $200,000, has been formed to manufacture the Farmobile, a machine which can be used in the field or on the road and which has been described and illustrated in past issues of this journal. The officers of the new company are as follows: President, C. J. Eastman, Los Angeles; vice-president, W. J. Miller, former vice-president and general superintendent of the Oscar Lear Automobile Company; secretary, M. W. Kounds, president of the Ohio Manufacturing Company; treasurer, James G. Stewart.

It is understood that the machine will be equipped with a rotary engine. The title of the concern is the Farmobile Manufacturing Company. Its plant is located at Springfield, Ohio.

THAT STERNBERG WAGON PERFORMANCE.

LAST month in describing the journey of a Sternberg wagon from Milwaukee to Chicago, through snow, it was inadvertantly stated that the machine was rated to carry one ton. The actual rating of the vehicle is 1,000 pounds. The net load was one ton. The size of the front axle of this machine is 1⅝ inches, not 1⅜ inches as stated in our description of it.

Motor cab service across the Queensboro bridge in New York City is being considered. The bridge is not yet open to traffic. After it is open it may be a year before trolley car service across it is available to the public.

The Adams Motor Transfer Company, of Boston, Mass., has been organized with capital stock of $100,000.

Several people were seriously injured last week when a motor driven fire vehicle, which was being demonstrated in Akron, Ohio, collided with a telegraph pole.

To indicate which of its cabs are for hire during the night one of the London companies burns a small electric lamp at the end of the taximeter mast flag.

Five-ton truck built by Ralph L. Morgan, of Worcester, Mass., described in the February number of the "POWER WAGON."

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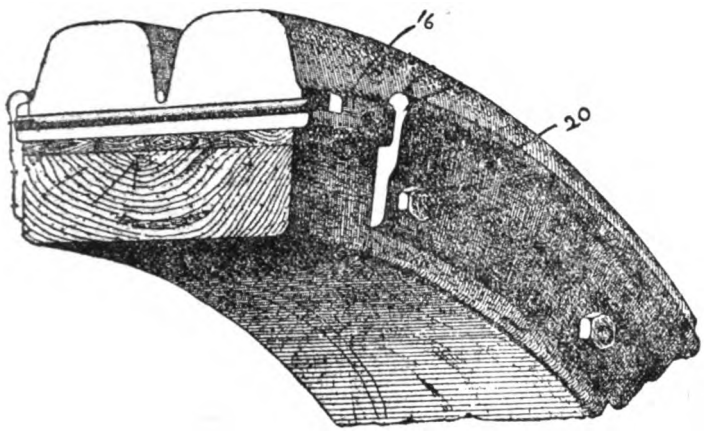
FIRESTONE ACQUIRES A NEW TIRE.

SOME years ago C. A. Merien, in charge of the Anheuser Busch company's extensive motor wagon installation at St. Louis, invented a bolted on tire which the Firestone company made to his order as equipment for five of the brewery's machines. Recently the Firestone company purchased the patents under which this tire was manufactured.

The patent states that the object of the inventor is to construct a tire in which the crossbars would be free to move inwardly without bending under the weight of



the vehicle when supported by the adjacent part of the tire. In order to accomplish this the cross rods are cushioned with the resilient material of the tire so that the annular members which engage with the crossbars do so only at the outer side of the bars.

Another object of the invention is to provide additional means for holding the tire in place by having the annular members above referred to engage not only the crossbars, but also a portion of the tire itself.

Each of the rings 16 is split. The outer edges of the rings are beveled. Secured to each side of the rim by means of bolts 20 are annular retaining plates, in the inner face of each which is formed a groove adapted to receive one of the rings. The outer of each of these grooves is beveled to correspond with the bevel on the outer edge of the rings, so that when the retaining plates are drawn into position by means of the bolts the rings will be drawn toward the center so as to firmly seat the base of the tire against the rim. This is allowed by means of the split in the rings referred to. The outer edges of the retaining plates are rounded so as to avoid injury to the tire should it come in contact with such edges. The inward rounding of the tire prevents any contact between the tire and the rounded portion under normal loads, and therefore there is practically no liability of the tire being caused to split from the sides toward the center. In case the tire should become loose through excessive wear, the retaining plates can be removed and replaced with new plates having grooves of slightly less external diameter, so that the tire would be again firmly drawn against the rim of the wheel.

The Motor Transfer Company of Fort Wayne, Tex., has been formed with capital stock of $10,000.

RUNABOUT AND TRAILER.

NECESSITY often compels owners of automobiles primarily intended for pleasure driving to make use of the machines for commercial purposes. It may not be good practice to haul large loads in this manner, but expediency is a doctrine which is frequently found to be higher than custom. Such apparently is the case with the Mitchell runabout owned by Ernest Diefenderfer, of Enola, Cal., who by means of a spring hitch attaches a trailer to his car and, making a gradual start, pulls loads of a ton and more with the little machine.

It is quite a trick to start so heavy a load without rendering the engine power ineffective. The employment of the spring hitch avoids sudden jerks and prevents the engine from stalling. This spring hitch is a ⅝-inch drawbar with a 3-16-inch spring. The drawbar is attached to the automobile frame by drilling a hole through its rear section and slipping the bar through this opening, putting the spring in place and finishing the work with a large washer and two taps so as to prevent jerking or stripping of the thread on the drawbar. The trailer is a wagon of the express type.

The Manhattan and Essex Auto Express Company, of Newark, N. J., has been formed to transact a general transportation business with motor wagons.

All the year 'round motor cab service is being organized for Asbury Park, N. J., by a company which is provided with $25,000 working capital.

Preparatory to purchase, tests of a motor hose and chemical wagon have been made by the fire department of Springfield, Ohio.

An over-sensitive undertaker in Denver uses an automobile to tow his ambulance. In doing so he claims to avoid engine vibration which might distress a patient. The employment of a low flying aeroplane, or a flock of harnessed geese, would be a further refinement of this odd tractor practice.

Mitchell runabout pulling a ton load on trailer.

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MOTOR FIRE VEHICLES IN VANCOUVER.

LAST January three motor driven hose and chemical wagons were supplied the fire department of Vancouver, B. C., by the Seagrave Company, of Columbus, O. The chief of the department recently made a comparison of the work efficiency and economy of these machines with the performance and cost of maintaining horse drawn apparatus in equivalent service. Unfortunately, however, he overlooked the superior mileage and hours of service furnished by the machines. The novelty of the installation was so great that interested visitors from neighboring points insisted upon demonstrations, which naturally added considerably to the cost of maintenance. In the accounting, however, the machines were only given credit for the departmental work they had actually performed. Notwithstanding this waste, the official report shows that the total cost of operating the motors is much less than the cost of maintaining and operating horse drawn fire department vehicles.

The extra service which the machines afforded swells the total volume to three or four times that of actual fire service. Taking account of this loss, it is exceedingly probable that the cost of operating and maintaining the machines is at least 75 per cent less than would be required for horse drawn vehicles. It will be fair to presume that in a city the size of Vancouver 25 miles per week would be a good average of service for fire department motor vehicles. The record shows that since their installation they have been covering close to 100 miles per week.

By next Easter Atlantic City will be provided with a very extensive motor cab service.

Arrangements are being made for the operation of motor buses in Des Moines, Ia.

SWISS INDUSTRIAL VEHICLE TRIALS.

COMMERCIAL motor vehicle trials will be held in Switzerland under the direction of the war department next June. The competing vehicles will be grouped into six classes, five comprising motor wagons and trucks and one motor buses. The trials will last 10 days. A route of 625 miles has been selected, each daily journey averaging 62½ miles. Any fuel may be used. The loads will consist of bags of sand.

The hilly nature of Swiss roads promises to make this an exceedingly interesting test. Special trials of machines will be made over exceedingly difficult roads under full and partial loads. Some machines will be required to climb a grade of 15 per cent under full load, as well as to start when half way up such grades without help. It is also on the program for all the machines to negotiate a mountain pass 6,540 feet high. A minimum average hourly speed of 6¼ miles must be maintained, except in traveling over difficult ground, when the speed may be reduced to 3¾ miles an hour.

MOTOR POLICE WAGON FOR RICHMOND, VA.

UPON obtaining competitive bids the police department of Richmond, Va., decided to purchase a motor driven patrol wagon made by the American Locomotive Company. The machine is fitted with a 40 h. p. engine. The chassis is the company's stock pattern, fitted with a special body. It has great speed ability, a travel rate of 60 miles an hour being available whenever necessary.

It is expected that the Oshkosh, Wis., fire department will soon be supplied with a motor hose and chemical wagon.

It is expected that a motor wagon service will be established between Los Angeles and Wilmington, Cal.

Police wagon used in Richmond, Va.

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Wagon Maintenance

Tips to new drivers and caretakers about things likely to escape their attention

BY the term "driving" many understand nothing more than the steering and controlling of a machine. Interpreting the full and clear meaning of the word, however, it is evident that driving is an art which not only includes guiding and controlling, but charges the one assuming these duties with a large share of responsibility for upkeep and maintenance. The motor wagon demands good care and constant attention to keep it in prime working condition, and, if neglected, we may be certain that trouble and annoyance will follow. Little things are often of greater importance than those of larger size, and, as the motor car is a creature of many parts, it is attention given to the "details" that will insure success.

* * *

Treatment for Foul Cylinders.

That gasoline wagons may at all times run smoothly and powerfully it is highly important to keep the inside of the cylinders clean. There is no excuse for letting this part of the motor become foul—it is rank negligence and nothing else. If the cylinder and piston-head become encrusted with carbon; is it any wonder that the engine knocks, pounds and loses power? In some cases the piston-heads are so choked with this deposit that it seems incredible that any motor could run under such conditions. The cause of this is the oil used for lubricating the cylinders. While all oils contain some carbon, those grades having a low fire test will obviously foul the cylinders much quicker. As the temperature within the cylinder is about 1,000 degrees Fahrenheit, it must be evident that a low-test oil will be entirely burned up and consumed before it can fulfill its mission of lubrication. It, therefore, stands to reason that only a high-grade gas-engine oil should be used in the cylinders, and such an oil will have a flash point of about 450 degrees Fahrenheit. The driver should never allow the cylinders of his motor to become carbonized to any extent. He should frequently flush them out. This may be done as follows: Unscrew spark plugs, and place pistons at the outer end of the strokes, or at the outer dead center as per mark on the flywheel. Now fill the cylinders—through the spark plug holes—with kerosene and let it remain overnight. The next morning open the pet cocks in crankcase, or, better yet, unscrew them, and drain out the dirty kerosene. This done, replace pet cocks, start the motor, and open the pet cocks to blow out any deposit that may remain in the cylinders. Cylinders should be cleaned in this manner at least twice a month—every week will be better—and if this is done often, no considerable deposit of carbonized oil will accumulate, and the vehicle will always run at its best.

* * *

To Prevent the Cooling Mixture from Freezing.

When the temperature is as low as 15 degrees Fahrenheit below zero, a mixture of water and alcohol—33 per cent. alcohol—resists freezing perfectly, even when the wagon is left outdoors all night. With the temperature around 50 or 60 degrees Fahrenheit, this mixture will boil slightly. It is not probable that the temperature will drop below 10 degrees above zero before the first of January, in which case 15 per cent. of alcohol in the mixture is enough. As the season progresses and zero temperatures are likely, nothing less than 25 per cent. of alcohol is safe. The combined use of glycerine and alcohol mixed with water solves the question for both hot days and cold days. The boiling point of glycerine, being higher that that of water, will balance the low boiling point of alcohol, so that the boiling point of the mixture will be reasonably high. As the percentage of glycerine required to meet a given temperature is much larger than the required percentage of alcohol, and as a matter probably of comparative cost, a mixture of alcohol and glycerine for use in the water is better, although glycerine slowly but surely destroys rubber tubing connections. A mixture of water and glycerine—30 per cent. glycerine—will freeze at about 15 degrees Fahrenheit. To be safe at 10 degrees below zero, about 55 per cent. of glycerine in the water is necessary. Twenty-five per cent. of half alcohol and half glycerine added to water, will resist freezing at 8 degrees Fahrenheit. Thirty per cent. of half alcohol and half glycerine added to water will resist freezing at practically 10 degrees below zero. When the half and half mixture is used the best result will be obtained by adding a small quantity of wood or denatured alcohol from time to time, as the weather gets colder. The right way to handle the cooling mixture is to find out the equation for your own car, using all the alcohol you can stand without boiling the mixture on mild days sure to be met in winter in this climate. Some machines will stand all alcohol, that is, mixed with water; others will not, and glycerine must be used to keep up the boiling point.

* * *

To Avoid the Dangers of Back-Firing.

A motor equipped with make-and-break ignition usually has the igniters set fully retarded, i. e., to fire a fraction of an inch past dead center. On a motor of this type a back-fire is very liable to occur if the spark lever is advanced only a few notches. In order to escape the serious consequences that may follow this—many arms and wrists have been broken—a good habit to cultivate is that of returning the spark advance and throttle levers to the proper position for cranking the motor before leaving the machine, or immediately on stopping the motor.

* * *

Rusted Springs.

If the springs have become very much rusted the only cure is to take them down. This will necessitate jacking up the frame and supporting it while the spring shackles are released and their running gear detached. The springs will then have to be dismounted, each individual leaf cleaned with emery cloth, well lubricated with grease and remounted. Do one spring at a time so that the leaves, bolts, etc., may not become mixed.

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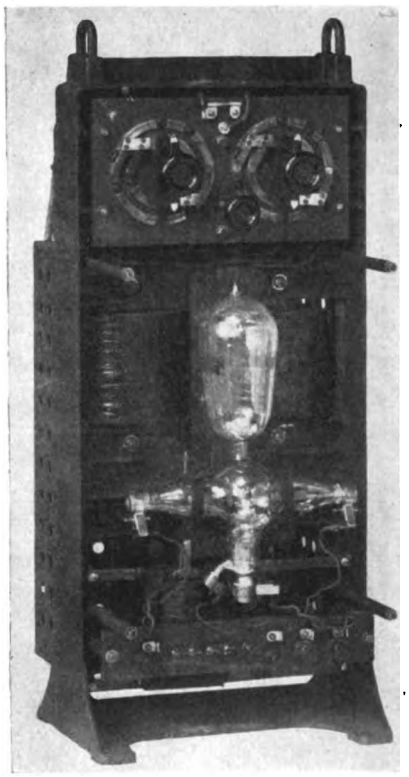
RECTIFYING CHARGING OUTFITS.

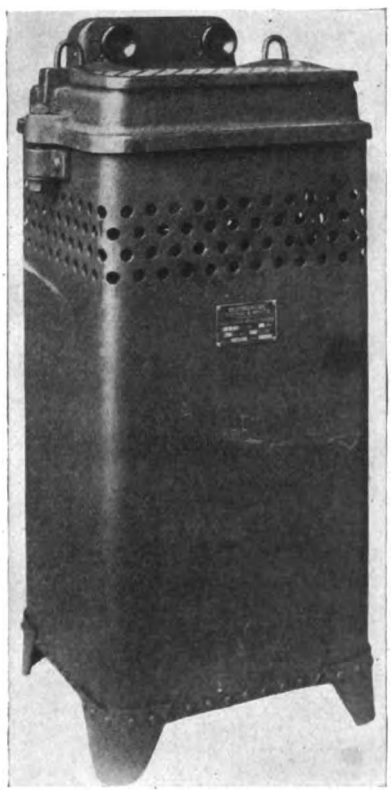
HIGH efficiency at both full and light loads, simplicity in operation, compactness and long life distinguish the mercury rectifying battery charging outfits made by the Westinghouse company.

The mercury rectifier provides a means of converting alternating current into direct current without the use of moving machinery. The charging of the storage batteries for electric automobiles is one of the handicaps under which this otherwise desirable type of vehicle has labored. Previously it could only be used when direct current was available, and the charging needed more or less expert attention. With the use of the mercury rectifier these disadvantages vanish. Moreover, the use of this rectifier is not confined to the charging of automobile batteries; it can be used for charging telephone, railway signal and ignition batteries, and various other operations requiring direct current.

The type "A" rectifier can be readily adjusted for charging any battery, and is entirely automatic in its action. It is only necessary to set the regulating dial pointers according to the table on the instruction card on the outfit. The rectifier outfit is cut into the vehicle battery and the primary current supply switch closed. The rectifier is immediately started, and proceeds to supply direct current. No readjustment is necessary during the charging. If the current is interrupted from any cause the rectifier automatically stops itself.



Westinghouse rectifier with cover removed.



Westinghouse type "A" rectifier.

The type "E" mercury rectifier is a small, self-contained set designed for charging automobile or other sparking batteries. It is similar in principle to the other rectifiers, but is smaller in size and capacity, and is mounted on a small panel which can be bolted to the wall.

These outfits have an extremely high efficiency at both full and light loads. They are so simple in operation that they do not require skilled attendants, and their performance is always reliable. They occupy small floor space. The bulbs are entirely protected from mechanical injury.

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Advertisements under this heading are charged for at the rate of three cents a word, including address; minimum charge $1 *for each insertion; no illustrations; cash must accompany order.*

FOR SALE: A 5-ton electric truck, made by the Electric Vehicle Company; in good shape and extra batteries; price, $2,000. P. O. Box 115, Station A, Hartford, Conn.

ATTRACTIVE ARRANGEMENTS CAN BE MADE FOR RENEWALS FOR "Exide" VEHICLE BATTERIES

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The Power Wagon

A Journal for Those Employing Commercial Motor Vehicles

No. 52 **MARCH, 1909** No. 52

PUBLISHED THE FIRST OF EVERY MONTH BY

THE POWER WAGON PUBLISHING CO.

SUBSCRIPTION RATES:

One Year (Domestic)	$2.00
One Year (Foreign)	3.00
Single Copies	.20

PUBLICATION OFFICES:
THE METROPOLITAN BLOCK
Chicago, Illinois.

Advertising Rates on Application

WALTER WARDROP, Editor

Entered as Second-Class Matter December 2, 1907, at the Postoffice at Chicago, Ill., Under the Act of Congress on March 3, 1879.

Records of Successful Operation

Express company which operates 40 electric wagons saves upwards of $35,000 a year

CONSIDERING how strong is the inclination to keep competitors in the dark concerning business methods of which we ourselves enjoy an advantageous monopoly, it is really remarkable that any trustworthy evidence should be available for confirming the economy of the motor wagon. There is no shortage of general approval of the machine's usefulness. But the very weight of such testimony, unsupported as it is by actual experience in motor haulage, inclines conservative business men to disregard it. What they seek is concrete truth, the demonstrable proof of the machine's superiority, the cash balance in its favor.

As with many other things in commercial life, belief in the economy of the power wagon springs from the wish to be convinced that it actually exists. And though sometimes this expectation is disappointed, the desire to see it fulfilled persists. The failure of a competitor only slightly affects the course of policy pursued by a philosophic business man. Error is too common, too human a quality, for its detection to be regarded as cause for the abandonment of the enterprise in which it is committed.

* * *

Beyond all question very many successes have been scored in motor wagon transportation. The thousands of machines at present employed would denote as much, if indeed the enormous volume of their daily work did not completely substantiate it. But it is not the voices of the triumphant operators which are always heard. Their modest exultations are occasionally smothered by the harsh cries of a few luckless adventurers who have thought to cash their eagerness to engage in a new pursuit. There is no escaping the company of these unhappy people. They will be with us to the end. However, it is comforting to remember that their influence wanes as it is more widely diffused among the large and rapidly growing body of owners. In the day when only a few hundred concerns were using motor wagons it was terrifying to hear their imprecations. Today they furnish not a little amusement.

* * *

The records of successful motor wagon operation are only obtained with great difficulty. The reason for this is quite obvious. Few care to spill information which for a while at least can be used as a valuable working asset. Of the records available, however, candor compels us to remark that few of them would pass as evidence before a court of strict inquiry. They lack symmetry and proportion. But especially are they deficient in that nice quality which every proposition which can be proved should possess, namely, artistic verisimilitude. Close analysis, which should be a conspicuous feature of all motor wagon accounting, is seldom discoverable in the reports of successful operation to which public attention is directed from time to time. Matters of small consequence are painted large, while really important features are drawn correspondingly small. Experience in preparing such documents will undoubtedly change all this and provide a standard for motor wagon accounting which will do full justice to the machine and the intelligence of those who use or propose to use it.

Meanwhile let us be thankful that operating services do provide records which, however meager and incomplete they may be, possess the rare merit of carrying conviction to those who examine them attentively. Viewed in this light every scrap of evidence which attests the machine's economy is of great value. The proof may not be

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complete, but it is so abundant, and so alike in general character, as to have but one result. In a court of law circumstantial evidence which is well supported has all the value of direct testimony.

* * *

It is generally known among motor wagon transportation experts that an express company in New York City which employes 40 electric vehicles has operated its business for the period of a year for $35,771.93 less than it was able to do while it employed 53 horse drawn wagons in the same work. Note that this is only the result obtained from a single year of experience with the machines. It is reasonable to expect that this economy will be increased as administration practices become more refined. All the subtleties of motor wagon transportation are not to be learned in the short space of a twelvemonth. Note also that though a handsome profit was made upon the investment the service was greatly improved. It is further known that a greater volume of business was taken care of by the machines than it was the habit to assign to the horse drawn wagons which they superseded. Thus the actual sum saved is probably much more than appears. Upon striking a balance between the two forms of transportation for the period indicated it was found that it cost $149,674.05 to maintain the draft animal equipment, while the cost of the machine installation was only $113,902.12. This represents an operating cost reduction of about 23 per cent.

MOTOR BUSES IN PITTSBURG.

NEXT month motor buses will be seen in competition with trolley cars in Pittsburg upon a scale sufficiently extensive to demonstrate the shortcomings of local fixed rail transportation.

A contract has been signed by the Automobile Transfer Company and the Duquesne Incline Plane Company whereby the former will undertake to transport passengers transferred by the latter from the foot of the plane on the south side to the heart of the city at Fifth and Liberty streets. Machines seating 22 people will be employed. Four-minute service will be maintained during the busy hours of the day. At other times the buses will be operated on an eight-minute schedule. The distance to be covered is a little more than a mile. The run will require about four minutes.

This enterprise is the result of the outright refusal of the trolley company to accept, as formerly, the transfers issued by the Incline Plane Company.

Plans are being formed for the operation of a motor bus line between Calera, Columbiana, and Montevallo, Ala.

Motor cab service will soon be provided in Springfield, Mass.

Motor bicycles are to be used by the New Orleans police officers who are assigned to control automobile traffic.

HOW FINAL DRIVE AFFECTS TIRE WEAR.

NOT long since it was publicly stated that as much tire mileage could be obtained from a gear driven motor bus or truck as it is customary to expect from machines which are chain driven. The recognized champion of chain driving, Hans Renold, upon encountering this assertion, immediately flew to arms and issued the following statement:

"If the figures on this subject, in the possession of the tire makers, were available, the question could easily be settled; but, for obvious reasons, they are difficult to obtain. We have, however, the definite assurance of a leading tire manufacturer of long and extensive experience in heavy work, that the advantages are invariably in favor of chain-driven vehicles so far as tire wear is concerned. The small unsprung weight and the slight elasticity of the transmission, due to the use of chains, give to his certain knowledge at least a 10 per cent longer life.

"Dealing with the cost of upkeep of chains, it is obvious this will vary with the quality used and the care given to them. Silent chains give results which make the replacement charges at current prices about $125 per bus per annum. The normal annual travel for a motor bus in metropolitan service is 30,000 miles. Remembering the heavy cost of tires as compared with that of chains, and the influence which the form of transmission has on their life, the cost of replacing chains should be set against the saving in tires.

"It is true that gears run in oil. But similar provision can be made for chain gear. With this provision the elasticity of the chain drive, the reduction of unsprung weight, the strength of the solid dead axle, and the cheapness of construction, can hardly be obtained in any other way. With some notable exceptions, chains have not yet had a fair chance in motor work, and the excellent results they are giving under adverse conditions must again lead to their large application."

THE IRONY OF FATE.

THE horse-drawn ambulance owned by the Society for the Prevention of Cruelty to Animals in Philadelphia will soon be discarded for a motor vehicle. The society has determined to pension its fine prize winning animals, Tom and Jerry, finding that they are not able to respond to all the calls made upon them in the course of a day. As the motor wagon gains in popularity the society will find it necessary to discover a new field for the practice of its humanity. Good friend as it has been of the much abused horse, it must shortly leave him to his fate.

Still there remain the cats and the dogs, and the other members of the lower creation which humans have domesticated. The S. P. C. A. will always have a decent opportunity for exercising its vigilance while these exist.

The night horse cab drivers of Denver are endeavoring to form a school where the operation and administration of motor cabs may be learned.

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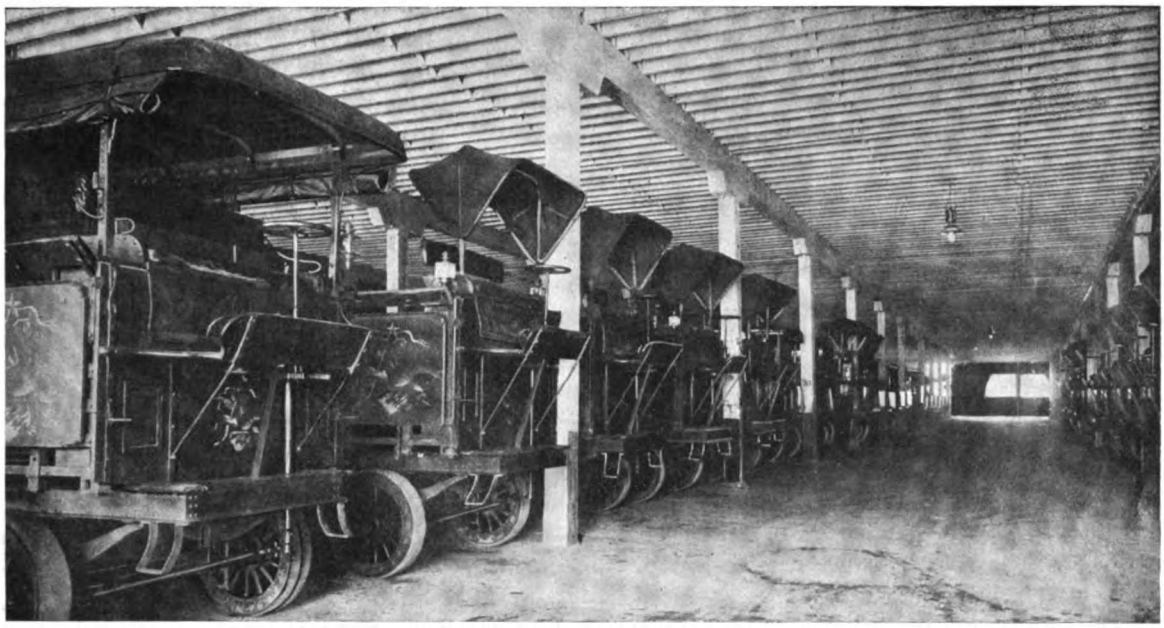

Part of the Anheuser-Busch Electric Wagon Stable.

Efficiency of Electric Wagon Service

Brilliant administration of 53 machines employed in the service of the Anheuser-Busch brewery

BEFORE the Anheuser-Busch Brewing Company's motor wagon installation reached its present large proportions—it now consists of 58 machines, of which 53 are electrics—it was common to find a large percentage of the vehicles out of commission for one cause or another. This state of affairs was chiefly due to incompetent administration and the lack of spare vehicles. Today it is rare when more than one-quarter of one per cent of the equipment is ever out of action during the course of a month. This altered condition is wholly ascribable to the strict attention which is paid to administrative detail.

* * *

The Anheuser-Busch company's experience with electric wagon transportation began at a time when the cooperation of battery manufacturers was not so easily obtained as it is today. To a large extent, therefore, the company was thrown upon its own resources in operating the first lot of machines which it purchased. To add to the difficulty which was normally encountered, the company committed the error of nominally intrusting its machines to the care of high-priced executive officers whose interest in their service was more academic than practical. Nearly everyone in the establishment had something to suggest for the handling of the machines on the road and in the stable. Under such conditions it was but natural that the service efficiency should have been quite low. The employment of a superintendent of motor traffic soon straightened out the confusion which had arisen and developed the best working capacity of the machines. Under his administration it is now easily possible to keep 48 of the 53 electrics in constant daily service, notwithstanding the great activity with which they are operated.

A record of a month's service of this installation is typical of what might be expected in an establishment having an equal or even smaller investment in electric wagons. It appears from the books of the company that during the course of one of the winter months just past 28 machines did not lose a single minute's service for any reason whatever; that 16 missed but one day apiece on account of the drivers not reporting for duty; and that four lost from one-half to a full day on account of abstraction from service for repairs. It is doubtful if any motor wagon installation in the country can make a much more brilliant showing than this, unless possibly it be that of the Adams Express Company, which also is known to be operated with great skill. It is very evident that the success which attends the administration of the Anheuser-Busch company's machines is not due to any special excellence inherent in the vehicles, for many are of a rather remote period. This only confirms the statement which has so often been reiterated in this journal, namely, that the service of a motor wagon is only mildly dependent upon the nature of its construction. Its economic operation is in a large part due to the skill exhibited in maintenance and administration.

* * *

Another highly interesting feature of the Anheuser-Busch company's service is the very modest stable expense incurred in keeping so many vehicles on the road. The barn force consists of one machinist, one battery man, a boy, a foreman and two washers. It is one of the peculiar advantages of electric machines that the stable help required for a large installation does not increase in proportion as the number of vehicles employed is swelled. One battery caretaker in all probability would be sufficient for the Anheuser-Busch company even should the number of its wagons be doubled, and as this workman is, with the exception of the superintendent of the traffic department, the only high-priced man in the stable, no appreciable

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administrative expense would have to be added in order to greatly increase the volume of tonnage moved.

Half of the Anheuser-Busch electric wagons were produced in the Waverley company's factory at Indianapolis. They are chiefly machines of 3,000 pounds rating, many of them having been built to the brewing company's specifications. They are a little heavier than the manufacturers would like to see in use, but as they do not give any trouble there is no quarrel between seller and buyer upon that account. On an average each month two or three machines are taken out of commission and thoroughly overhauled. This practice is performed at no loss to the service, as the company maintains a fixed number of spares in proportion to the number of machines which are required for active daily work.

BIG HORSE WAGON INVESTMENT THREATENED.

PREPARATORY to replacing the draft animal equipment of its 325 branch houses the Great Atlantic & Pacific Tea Company, having headquarters in Jersey City, N. J., has bought five motor wagons with which it will earnestly endeavor to establish a new mark in economic delivery. Until these machines have proved their value the company will not do more than casually consider the retirement of its 1,500 horse drawn wagons.

The machines have been purchased from the Autocar company and will be put in service in the Baltimore, Newark, Washington, Passaic and New Jersey establishments.

TAXIMETERS TO BE OFFICIALLY INSPECTED.

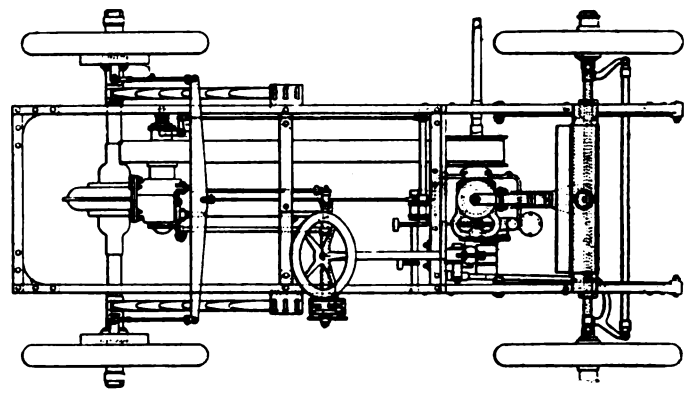
HEREAFTER the use of inaccurate taximeters will not be permitted in Washington, D. C. A regulation approved by the District Commissioners makes the use of an inaccurate instrument punishable by a fine of not more than $40, to be levied on the company or owners of the automobile carrying the meter. The regulation also provides that no taximeter shall be used in the district until a guarantee of accuracy has been filed with the official cab inspector.

The sum of $4,000 has been appropriated by the Davenport, Ia., authorities for the purchase of a motor police patrol wagon.

The license fee for a motor cab in Los Angeles is $5 per month. Efforts are being made to have it reduced to $1 a month.

BELT-DRIVEN MOTOR CAB.

FOR the transmission of engine power to the rear axle the makers of a French motor cab use a belt instead of any of the usual mechanical devices. On the left-hand end of the crank-shaft a pulley is fixed. From it a belt transmits the engine power to another pulley which is mounted on the main shaft of the change speed gear. This second pulley is also the external member of a cone type of friction clutch, by means of which it drives the gear shaft. The internal member of the clutch is mounted on a



squared portion of the gear shaft and is actuated by means of a foot lever. Change speed gear and differential are enclosed in the same casing and carried back to the rear axle. Two gear changes are provided.

The cab is fitted with a 9-hp. single cylinder engine. The method of suspension is also unusual, the forward part of the frame being supported over the axle by means of semi-elliptic springs, while inverted quarter elliptic springs are used in the rear. One of these machines was awarded the second honor at the recent French trials.

WILL BUILD WAGONS AT WAUWATOSA, WIS.

ANNOUNCEMENT is made of the formation of the Power Vehicle Company, of Wauwatosa, Wis. The firm will produce a one-ton gasoline wagon, friction driven. The friction drive is of the double variety. The machine is without differential or jack shaft, the rear wheels being individually driven. A double-opposed engine, rated at 30 hp., is employed. The officers of the company are: John Salentine, president; George L. Salentine, secretary and treasurer.

A motor police patrol wagon has been ordered for duty in New Orleans.

A Column of Anheuser-Busch Machines Returning from Work.

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Needs of Chicago's Fire Service

Fire Marshal Horan declares for the employment of motor driven vehicles in the residence districts

ALTHOUGH at present there is no motor apparatus in the Chicago fire department other than a couple of automobiles used by the officials in charge, there seems little doubt that the auto will be the coming factor in fire fighting in the course of time. Experiments in other cities and countries have proved satisfactory, and as soon as conditions can be made favorable it seems as if the motor fire machine will be generally adopted.

While there have been some unsatisfactory tests with the new style of apparatus, these were often because the old type of machine was too closely adhered to. When the first autos were built for passenger use they followed the lines of horse-drawn carriages. When the first motor fire apparatus was put on the market the general lines of a horse-drawn engine were copied. The engines were built with high wheels and with the boiler well up in the air.

As a result, skidding, which would be ignored in the modern auto, became a source of danger. There was always a chance that the engine, with its weight high in the air, would upset on the slightest skid. This has now been entirely changed. The weight in the new machines, with which several firms are experimenting, is suspended well down between the wheels, and there is no more danger of an upset than there is in the average passenger auto.

* * *

The modern style of apparatus provides for the use of the propelling power as a pumping force. When a fire plug is reached the power is shifted to the pump, and the work is done by the same force that drove the vehicle.

It would seem as if gasoline or alcohol will be the coming means of power for fire apparatus, on account of the saving in weight. There has been much talk of electricity, the idea being to have the fire plugs connected with an electric circuit so that an extremely light pumping apparatus—possibly no heavier than the average touring car—could be driven up to the plug and connected at once. This could undoubtedly be done, but we have hardly reached that stage of development as yet. Moreover, one circuit would never do. There would have to be several, so as to avoid all possibility of a failure of power at a critical moment. If this system is ever adopted the auto will stand out as a controlling factor in the fire fighting line.

* * *

There is one great field for the motor-driven fire machine—that is in residence districts and in the suburbs. High speed in a district such as the loop region of Chicago is an impossibility at most hours of the day on account of the traffic. A three-minute speed can probably be taken as the average a department could expect to make. But in the suburbs and dwelling districts, where the streets are clear, especially in those regions where frame houses abound, and where it is necessary to reach the scene as quickly as possible, the high speed of an auto would be of the greatest value.

Here is where the power vehicle is of such value in certain small cities where the style of building is such that a chemical engine can either quench a flame or hold it until a steamer arrives. So long as the streets are good the chemical can be on the scene almost at once and danger from fire is greatly lessened.

Where an auto-driven chemical engine of the style suggested would be of the greatest value would be in the saving of weight. At present, chemicals and extinguishers are filled beforehand. The weight of the water is a serious matter, even in the present-day hose carts, which carry a tank filled with the preparations used to extinguish a blaze. If connections with the fire plugs could be made practicable, it would be possible for the engine to run with empty tanks to a fire and get its water on the scene.

* * *

Many think that foreign countries are ahead of us in the matter of taking up motor apparatus, but it is not our fault—it is the fault of the streets. In cities like Berlin, where motor vehicles are never called upon to go off paved streets, they are far more available than here, where they may have to make a run within the city limits and yet go through unpaved districts. There are plenty of regions the city fire department is called upon to cover where the independent weight of the horses is an actual need.

* * *

To make the speed of the auto of the greatest value, however, there is one point I would like to bring out—that is the need of an auxiliary alarm service in the big plants by which the department can be summoned the moment a blaze is discovered. With this system and with the use of automobiles, much time could be saved. There would be none of the delay consequent upon the watchman having to go two blocks or so to the nearest box. And if an independent auxiliary system was installed, an accident to one line need not affect the other. Alarms over the telephone, of course, only bring one company to the scene, while the auxiliary system would call out several.

Taken all in all, there can be no question that motor-driven fire apparatus has come to stay and has a big future before it.

JAMES HORAN,
Fire Marshal City of Chicago.

PITTSBURG'S POLICE WAGON.

PITTSBURG'S new police wagon is an interesting machine. It was made in the Pierce factory and will be used in hurrying men to the scene of a riot, or for other emergency work. It is fitted with dash cabinets containing revolvers and handcuffs, while heavy holsters, large enough to hold three high power rifles, are attached to the back of the front seat. On the running-boards are two fire exinguishers. The vehicle is driven by a 40-hp. engine.

Lamar, Colo., has been supplied with a motor hose and chemical wagon costing $4,000.

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The Quickly Removable Power Plant

The expense of maintenance is greatly reduced by this novel feature of vehicle construction

IN CONSIDERING the matter of easily, surely and speedily repairing any derangement of the motor wagon's power plant Max Grabowsky, the creator of the machine bearing his name, did not hesitate to discard previous design practice. In arguing the advantage to be gained by making this important part of the mechanism completely removable he says:

"The power wagon that successfully competes for favor on a strictly economic basis must be in service practically every business hour of every working day, with a cost of maintenance and the loss of time for necessary mechanical attention, repairs, etc., reduced to a minimum. Several years ago it became apparent that the chief reason for most of the time lost and money spent in maintaining power wagons lay in the fact that the power plant on the best cars of that time, those of my own design included, was entirely too difficult to reach and inspect as often as necessary to keep it in good running condition. The result of this inaccessibility was neglect, and neglect meant another man who raised his voice against the cost of power wagon delivery.

* * *

"After careful study I hit upon the idea of a removable power plant. In this the engine, the transmission, and control form one unit under the hood of the car. This unit is assembled on a sub-frame, which is independent of the car frame members. Attached to the car frame members are two channel steel sections, corresponding to and telescoping sub-frame sills, which maintain the position of the sub-frame in the car. The operation of removing the power unit is simple in the extreme. By removing two bolts, and breaking six quick detachable connections, the sub-frame, with the entire power plant mounted thereon, can be drawn forward until it is completely detached from the car. In this position it is supported by a portable tray with steel supports, and it can be inspected, adjusted, or, if necessary, extensive repairs made easily and with no great delay. Or, if desired, the entire unit can be taken out and its duplicate inserted, leaving the question of adjustment or repairs until a later time. The removal of the power plant is a one-man operation, and can be effected in a few minutes, with no tools but an ordinary wrench.

* * *

"A little reflection will show that this new principle in construction is revolutionary in character, and is easily the most important feature that has recently been developed in this branch of the industry. Its benefits divide broadly into two classes—the lowered cost of maintenance to the man with one or two cars located at a point where repairs are difficult to make, and the possibility of maintaining a large force of cars, from twenty upward, at a cost hitherto found impossible.

"Already I have briefly sketched the advantages to the man with a single car. Constant inspection of the really important part of the mechanism of his car is easy at all times. Little faults can be cut off before they become serious difficulties, and the matter of adequate attention simplifies itself to a point where a novice can take care of his car better than ever before, without the expensive assistance of the garage expert.

* * *

"In the case of a battery of cars, say twenty and upward, the cost of maintenance simplifies itself still further with the aid of the quick detachable power plant. Whether these cars belong all to one operator or whether they belong to separate merchants who, for the sake of economy, have their cars taken care of together at a central point, the result is the same. The new power plant so simplifies the work of inspection and adjustment that a very small force of men, some skilled and others unskilled, can between darkness and daylight inspect, adjust, clean, polish and replenish the fuel supply of the entire battery of cars. If any one plant needs to be kept in over a day or two for repairs, it can be removed from the vehicle, its duplicate substituted, and the car can go to its work on time without a hitch, while the necessary repairs are being made.

* * *

"This is but a brief glance at the possibilities of the quick detachable power plant, and while there are many other important features to the perfect running power wagon, I believe this one feature in itself will do more than anything else to make power wagons the cheapest and most satisfactory method of handling and delivering merchandise in the future."

BIG CAB COMPANY ABSORBS SMALL ONES.

MEN exceedingly well known in automobile circles are responsible for the formation of the Taxicab Service Company in New York City, which concern was recently chartered with capital stock of $2,200,000. Winthrop E. Scarritt and Harlan W. Whipple are closely identified with the new enterprise. The former was once president of the Automobile Club of America, while the latter was at one time the chief executive of the American Automobile Association.

The company has absorbed the business of the two concerns which formerly controlled the motor cab service of two of New York's principal hotels, namely, the Waldorf and the Holland House. The capital stock is divided into $1,000,000 preferred, bearing cumulative dividends of 7 per cent, and $1,200,000 common. The charter of the company grants the right to transport merchandise as well as passengers by means of motor vehicles.

The company starts out with quite a number of machines formerly operated by the concerns which have been absorbed. This equipment will be extensively increased in order to take care of the business which it is expected the district below Fourteenth street can provide. Lower New York is very poorly served with motor cabs just now.

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Losses in Coal Haulage

Economy of the motor wagon much diminished by time wasted in loading and unloading

BEFORE they can thoroughly qualify for motor wagon investment many establishments must learn to recognize the difference between the economy which is represented by the potential capacity of the machine, and that which it may exhibit in practice.

Broadly speaking, firms which are contemplating the use of motor wagons may be divided into two classes, one consisting of those which resolutely intend to work the machines actively, and the other those which propose to operate them whenever it is convenient to do so. The former invariably constitutes the class which eventually obtains maximum benefits from motor wagon transportation. Many of the latter develop into quarrelsome, hypercritical and disappointed users who blame the machine for shortcomings which have origin in themselves.

* * *

It is surprising to observe the number of people who have fallen into the habit of considering the motor wagon merely as a vehicle. Its true classification is as a machine. Machinery of any kind which is only worked to 40 or 50 per cent of its capacity will inevitably make a poorer financial showing than that which is worked to full effective capacity. The proper adjustment of loading and unloading conditions, as well as routing, therefore, is of very great importance in developing the economy of the motor wagon. In service where its employment would seem to be indicated it not infrequently happens that its idle hours are almost as numerous as its active periods. If this state of affairs prevails in a service where draft animal competition has already caused the transportation cost to become very low, it is practically hopeless to expect that the machine will make a creditable showing. Such is often the case in the hauling of coal.

Yet despite the fact that a great deal of coal is hauled by horses at a surprisingly low figure, it is still quite possible for motor wagons, properly administered, to compete in such service. But the terminal loading and conditions must be such as will accommodate the capacity of the machine. The system of delivery must not be of a hybrid character. It must not present conveniences for horse transportation which are denied to mechanical transportation.

* * *

Many motor wagon manufacturers have had opportunity to judge how poorly adjusted are loading and unloading conditions in the mechanical haulage of coal. All are unanimous in saying that there is less science shown in the handling of this product than in any other of which they have knowledge. A few have earnestly sought to improve conditions in this field. But they have not been able to secure the whole-hearted co-operation of those having the chief interest in the outcome. The majority of makers have preferred to look elsewhere for buyers of their product. Among the few concerns which have striven to help retail coalmen the Couple Gear Freight Wheel Company, of Grand Rapids, is much distinguished for the intelligence with which it has conducted its investigations. Its manager, Mr. Brown, is not very hopeful of immediately convincing the coal dealer of the necessity for changing his system of loading and unloading, but he gives the impression that there is no occasion to despair of the eventual outcome. He says:

* * *

"The natural capacity of the horse is about 16 miles per day, while the natural capacity of the truck, we will say, would be in the neighborhood of 30 miles, under load, and until our coalmen get to the point of arranging for quick loading and unloading, which it will take some time to do, they will be unable to increase the percentage of gain from using the horseless vehicle. Until they do this, the sale to coalmen will be limited for no other reason than that they are unable, or unwilling, to arrange their business so as to make practical use of the auto-wagon.

"To give an idea of what the proper facilitating of loading and unloading would mean, I will say that during the past month in New York our truck worked 24 days, and was only allowed to move 108 hours, which you will see is less than half time. It delivered in a retail way during that time, 1,316,060 pounds of coal and traveled 395¾ miles. The average daily delivery was only 27 2-5 tons and the average daily running time was four hours and 30 minutes. Now compare this with what could be done by facilitating matters so as to give the machine a chance.

"During the month of September we operated that truck for the same people and one day secured a chance at doing the work as it really should be done, that is, we got one trip where we were allowed to operate with trailer and where the coal was loaded and unloaded promptly. The result was that we delivered 14 tons of coal over a 1¼-mile course and returned to place of starting in 55 minutes, making an average of something over 140-ton delivery, providing the outfit is kept in motion at this rate for ten hours, which could be done withhout any overexertion whatever. We are taking it for granted that under ordinary conditions this gait could not be maintained, and will deduct 50 per cent for various local reasons, which would give a delivery of 70 tons on a basis of round trips not exceeding 2½ miles, which is fully as much as the trips will average in any town where yards are fairly well scattered. Note, however, that under existing conditions in New York we were able last month to make a delivery of only 27 tons per day, the average round trip being 4⅓ miles.

"The key-note of the whole trouble is that facilities are not at hand for keeping the motor truck in motion. If it is allowed to stand still 10 hours per day the owner is much worse off than he would be if he had no truck at all, or horses either. If it is allowed to stand still five hours per day his chances of making good with it are lessened accordingly."

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ELECTRIC TRUCK FOR DOCK USE.

SEVERAL electric trucks like the one shown on this page are used by the New York Dock Company at its Brooklyn terminals. The machine illustrated has a load capacity of two tons and a speed of five miles an hour. With this load and speed the vehicle has a capacity of twenty miles on a single battery charge.

To reduce the labor of loading and unloading the truck is built with a flat platform two feet from the ground. It is 14 feet long and 4 feet wide. The two rubber shod side wheels are chain driven from a countershaft carrying the differential. The iron faced front and rear wheels, placed centrally in the frame, are used for steering and are operated together, turning in opposite directions and permitting the truck to swing around within its own length. Platform and frame are hinged in the middle to move on a tubular axis. This construction permits all four wheels to rest on the ground, no matter how uneven it may be, and relieves the frame of load at the center. The steering wheels and controller handle are removable. By lifting them out of their socket they are available for use at the other end of the truck. This double method of steering and control obviates the necessity for turning.

The motor is placed in front of the middle axle. The 60-cell battery is located behind the axle. The truck weighs 2,750 pounds. With suitable modifications it could be used on factory floors or in yards. It was made by the Lansden company.

Several of these trucks have been employed in the service of the Dock company for the past four months. They are kept busy hauling sacks of coffee from steamship to warehouse. When not engaged in this traffic they handle general merchandise to and from the steamship, and between warehouses along the water front.

The police board of Fall River, Mass., has asked to be supplied with a motor patrol wagon.

It is likely that Elizabeth, N. J., will soon be provided with two motor driven fire engines.

Fort Worth and Riverside, Texas, are now connecetd by motor bus.

POSTAL SERVICE MACHINES.

WHENEVER the postmaster of one of our large cities takes the public into his confidence and intimates that he hopes to obtain permission from the Washington authorities to collect mail by means of motor wagons, it invariably appears that his desire to employ the machines rests upon the assumed saving to be effected by their use. This view of the matter does not coincide with the government's usual policy in administering national service affairs. As a rule it is enough for the government authorities to recognize the superior efficiency of any given method of performing work in order to have it adopted. This has been especially true of the administration of the postal department; otherwise there would be no rural delivery, no pneumatic tubes, and no talk about the establishment of a parcels post.

The thought is altogether too common that the motor wagon should only be introduced into service in which its cash economy is revealed. Betterment of public service is of considerable more importance than the trifling loss or gain which might have to be recorded by using machines instead of horse drawn wagons in postal work. The government should not object even to paying a premium for superior service.

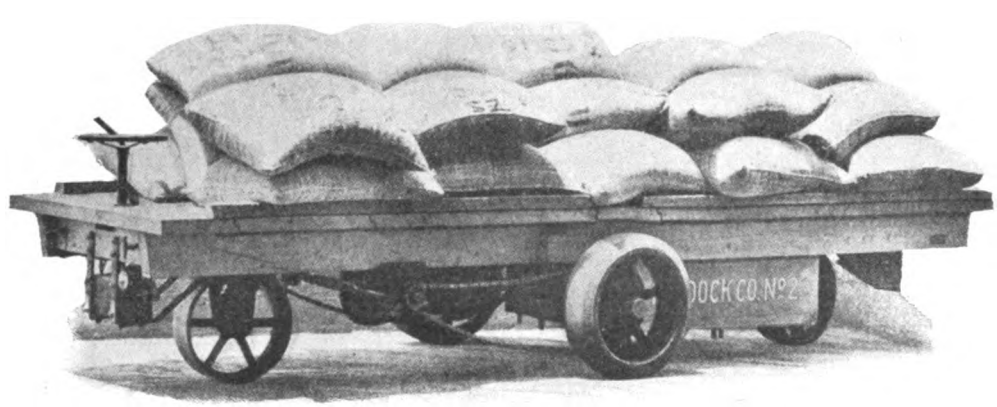
For $20 one can proceed by road from Philadelphia to New York City in an automobile. It is fifty years since coach service between the two points was discontinued.

There are now 2,923 motor cabs in Paris. A year ago there were only 1,465.

A general passenger, freight and express business will be conducted by Samoset Garage and Transportation Company between the summer resorts of White Horse Beach and Manomet, Ohio.

The purchase of a combination patrol and ambulance wagon for Harrisburg, Pa., is being urged.

A 29-mile motor bus line connecting Monroe and Cincinnati will soon be established. It will compete with the service furnished by the Big Four railroad. Each machine will carry 16 passengers.



Two-Ton Electric Truck Used on Docks.

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THE ARTFUL TEAM OWNER.

DOUBTLESS the views of a majority of Chicago's team owners touching the matter of street paving harmonize with those expressed by the worthy president of their association, who abhors and condemns every substance but granite.

The expenditure of public money for rough pavements is encouraged by the teaming interests for reasons exactly opposite to those which induce motor wagon owners to advocate the laying of smooth surfaces. Horses do their best work on streets which are inimical to motor traffic. Wherefore the obdurate enemies of the new method of transportation, with the teamsters in the van, seek to retard its development by insisting that the wheel tax fund, to which they contribute so heavily, should be largely spent in their interest. This is good strategy. But the merchants who hate noise, the health authorities who are determined to suppress unnecessary filth, and the people at large who are driven frantic by both nuisances, will in all probability pool interests as heretofore and provide many more miles of wood and asphalt streets in the downtown district.

With the object of creating sympathy for their cause the teamsters have organized a literary bureau, the first bulletin from which is as follows:

"While the wheel tax is a great injustice, I feel confident that the large majority of men operating teams would gladly pay it but for the uncertainty which exists over what they are likely to get in return for the thousands of dollars they pay into the city treasury. The streets of our city, which were originally laid out for the traffic teams, have been monopolized by private corporations. There is hardly a street in the downtown district where the team owner has any right except in the gutter. The sides are laid with such a slant to the curb that teams hauling loads in slippery weather keep coninually slipping to the curb, making it very hard for the horse and a great hindrance to traffic.

"Who has not stood on State street on a frosty day and seen many horses fall to the icy pavement or tremble in every nerve from fear of falling? I have had a good many years of experience as a team owner, and have come to the conclusion that the granite block is the best, most durable and cheapest pavement. It should not be as smoothly cut as it is now, nor laid with as much slant to the curb. I believe that granite pavement contains more moisture than asphalt or wooden pavement, and that it is better for the horses' feet. On it the horse can always get a footing, no matter what the condition of the weather, and the load can always be drawn easily, except after a heavy snow. Considering everything, I think it is the only proper pavement for streets where there is heavy traffic.

A. CHARD,
President of Team Owners' Association."

The formation of the American Wagon Company of Dover, Del., has been accomplished. The concern will make motor wagons and cabs. Its capital stock is $100,000.

ANOTHER CAB STRIKE.

WAGES form the basis of a dispute between the drivers of the Terminal Taxicab Company, of Washington, D. C., and the proprietors of that concern. The men decided that they would not accept 20 per cent of the gross receipts and furnish their own fuel. Formerly they were paid at the rate of 20 cents an hour. At the new rate of pay the men claim they cannot earn as much as they did under the old arrangement.

In explaining the disadvantages of the new system one of the men referred to a call he received the night before. He was ordered to an apartment house on Columbia Heights, a distance of nearly four miles from Union Station. At the apartment house he took one passenger and conveyed her about five blocks. The charge was 30 cents, A quantity of gasoline had been used in making the trip to the apartment and back to the station, and the only return to the driver, under the new rules, would have been 30 per cent of 30 cents, or less than 10 cents. More than half of this amount would have been eaten up in the purchase of gasoline.

NEW KNOX FIRE VEHICLE.

EVER since it first produced a machine for fire department service the Knox company has intelligently sought to maintain a high standard of efficiency for vehicles of this class. It is now completing a model which possesses many novel and useful features of design, the most conspicuous of which are a 60 hp. air cooled engine and a device for instantaneously connecting it with the pump in order to produce the desired hose pressure. This engine is the most powerful of its type yet produced.

HOMER TRUCK COMPANY ORGANIZED.

DURING the past two years the individuals composing the Homer Auto Truck Company, of Homer, Mich., have built a few gasoline delivery wagons which have been employed in local service. The success which attended the operation of these machines has led to the incorporation of the company, the capital stock of which is $25,000. Light and heavy machines, as well as gasoline engines, will be manufactured.

TO MAKE MOTOR TRUCKS IN CHARLOTTE, MICH.

MAKING automobiles for pleasure cost the operators of the Dolson factory in Charlotte, Mich., a good many thousand dollars. The enterprise was so unsuccessful that it became necessary to close the plant. Recently the property passed into the hands of parties in Battle Creek, Mich., who paid the sum of $15,000 for it. In the future motor trucks will be made in the establishment.

A light motor delivery wagon recently covered a Philadelphia route in two and a half hours less time than is required to cover it by horse drawn wagons.

Motor bus service is to be supplied between Kingston and Hamilton, Mo.

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MOTOR BUS TIRE MILEAGE.

SOME years ago the metropolitan bus company which obtained 7,500 miles from a solid rear tire had cause for congratulation. The enormous volume of traffic offered to these machines, and the rapid increase in their number, led makers to pay unusual attention to the compounding, shaping and general construction of their tires, with the result that today a set of rear tires which does not give 10,000 miles is considered a bad bargain. It must be understood that reference is made to the big machines which carry 36 passengers, weigh loaded a little more than six tons, and travel at an average speed of between 10 and 12 miles per hour. A record exists of four rear tires of the twin variety used in London service which have given the following mileages: 16,234, 15,682, 14,855 and 12,889. These tires are still in service and are undoubtedly good for a few thousand miles more apiece. There is also a record of four front wheel bus tires of the single variety, which respectively have yielded the following mileages: 16,205, 15,540, 17,910 and 16,490. Like the rear tires just mentioned these front ones are yet in a good condition of repair.

MOTOR CAB COMPANY REORGANIZED.

AT a recent meeting of the stockholders of the Taxi Company, of Boston, it was voted to reorganize the company by asking for exchange of the present preferred stock for stock in a new company on a share for share basis. The present company has $200,000 capital divided equally between preferred and common, of which $11,100 preferred and $58,600 common is issued. The common stock will be wiped out. The capital of the new company will be $200,000, all of one class, and the intention is to sell at once $50,000 of this stock, probably at par, and put the proceeds into the purchase of new cabs.

The plans further contemplate the purchase of a large livery stable business in Boston. This business will be discontinued and the equipment turned into cash as soon as possible. By taking over the livery business the company will have a three-story garage with storage room for 150 to 200 cabs, in addition to room for 50 operating cabs, repair shop, etc.

Early this month a motor hose wagon will be installed in Winchester, Ky. It will carry 1,200 feet of hose and a 20-foot extension ladder.

The Interborough Auto Bus Company, of Albany, N. Y., has been formed with capital stock of $15,000.

The Eureka Taximeter Cab Company has been organized in New York City with capital of $25,000.

It is expected that automobile fire apparatus will be bought for use in Decatur, Ala.

Taunton, Mass., is to be provided with motor cabs.

Motor cabs are to be operated in Plainfield, N. J.

THE SAFETY OF BRIDGES.

THE employment of motor trucks in the rural districts is teaching some valuable lessons to those who provide the surfaces upon which they run. Until their advent in such service the county officials who are responsible for the conditions of roads and bridges did not consider that any greater vigilance was necessary than it has been customary to provide in safeguarding horse transportation. Not being familiar with motor wagon practice, they have overlooked the great weight which is frequently supported upon an extremely short wheel base and the consequent danger from road subsidence and the collapse of bridges.

A striking instance of this official neglect came to light recently in the state of Pennsylvania, where a heavy truck owned by the Lehigh Valley Motor Car Company crashed through a bridge near Allentown, and with its three-ton load was submerged for a period of ten hours. Three-ton loads drawn by horses are comparatively common in rural haulage, but it is to be remembered that the total weight of load and equipment is not disposed in the manner observed in motor wagon transportation. The gross weight of a loaded three-ton motor truck, assuming the absence of overload, will in all probability be between 4½ and 5 tons. The wheel base may not be any longer than 110 inches. The horse outfit, for the same load, will not be nearly so compact and consequently the load pressure will be more safely distributed. Then, too, there is the matter of the motor wagon's higher speed to be considered.

Abroad there are well defined laws for the protection of existing road and bridge structures. Vehicles of whatever sort are prohibited from carrying loads which closely approximate the calculated resistance. Special care is taken that motor trucks, with their great dead and live loads, be not recklessly driven over river spans which were never intended to bear heavy traffic. It would be advantageous for all concerned if our county officials exercised like cautiousness. The majority of them are unacquainted with the special problems which have come into existence as a result of the employment of the motor truck, the motor bus, the motor hose and chemical wagon, and the other fast moving and high load machines of the commercial motor vehicle class. The number of these machines employed in rural districts is constantly increasing. Their use should be safeguarded.

Preparations are being made for the formation of a company to operate motor cabs in Portland, Maine.

The authorities of Marlboro, Mass., are considering the purchase of a motor hose and chemical wagon.

In order to secure better protection and lower insurance rates the citizens of Summerville, Ga., are advocating the purchase of a motor hose and chemical wagon.

In Boston the Adams Motor Transfer Company has been organized with capital stock of $100,000.

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MOTOR BUSES REPLACE HERDICS.

WASHINGTON, D. C., is determined to get rid of its antiquated herdics, a type of vehicle which long ago had outlived its usefulness in passenger transportation. A short time ago five motor buses went into commission. They were made by the Rapid Company.

In accordance with an act of Congress the Metropolitan Coach Company, which operated the herdics on Sixteenth street, was given until April to replace its rolling stock with more modern and serviceable vehicles. Machines to carry 14 passengers were selected as substitutes. The seats of the machines are upholstered in buffed leather. Wide plate glass windows light the cars by day, and electric lights are used by night. Electric bells are provided for signaling the driver. The 24-horsepower engines drive the buses over their 2½-mile route in 15 minutes, including stops, making the round trip from Fifteenth and U streets to Twenty-second and G streets in about half an hour. The route covered is the same as that of the herdics.

A Franklin bus is also in operation. It seats 16 passengers and is for operation without a conductor, the door at the rear being controlled by the driver by means of a strap. Fares are deposited in a cash box. The car is electrically lighted. The vehicle weighs 3,180 pounds. It is built on a truck chassis having a wheel base of 120 inches. It has a worm driven rear axle. The engine is air-cooled and develops 18 hp. The vehicle is geared to run about fifteen miles an hour. It is to be in service 17½ hours daily, running in that time 120 miles. The transmission is of the progressive sliding gear type.

At a recent meeting of wealthy residents of Hackensack, N. J., it was decided to urge the purchase of motor fire vehicles. The present means for coping with fire in the high class residence district is very inadequate.

NEW PARIS CAB TARIFFS.

THE bewildering assortment of tariffs which is a striking feature of Parisian motor cab service, is about to disappear. In the future there will be but three, one for machines which may be hired for the minimum fare, the second for machines which operate for the intermediate fare, and the third for machines commanding the maximum fare. The machines of the first group will be indicated by a red flag, those of the second by a yellow one, and those of the third class by a white one. The municipal authorities have decided to enforce these regulations. There are 172 concerns operating motor cabs in Paris. Of these 57 have been in the habit of charging 75 centimes for the first 900 meters, while 66 have exacted that sum for the first 600 meters. Then there were 26 concerns which carried passengers 1,200 meters for the same price, and 23 which had eight different tariffs. Nice situation, wasn't it?

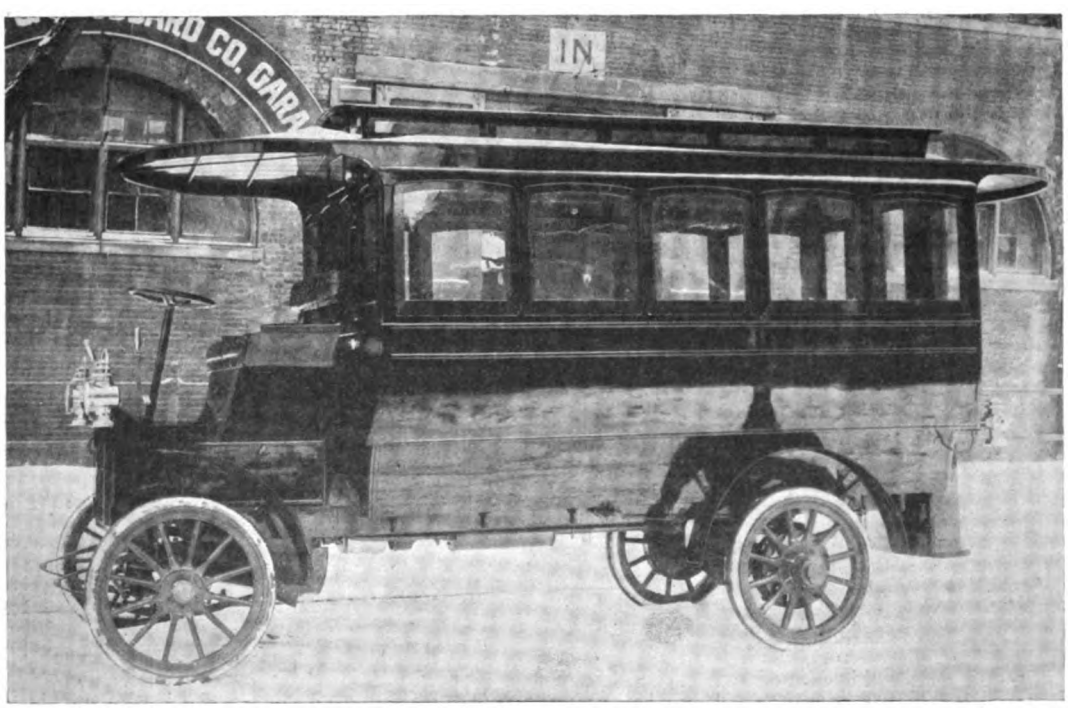
The fire department of Augusta, Ga., needs a motor hose and chemical wagon. The sum of $5,000 is available for its purchase.

The salvage corps of Louisville, Ky., has been supplied with a 40 hp. gasoline wagon, carrying eight passengers and ten covers, and costing $4,000.

The director of public safety in Scranton, Pa., has been instructed to investigate the advantages, economic as well as protective, of motor fire vehicles.

The fire department of Worcester, Mass., wishes to be supplied with two pieces of motor driven apparatus.

The installation of motor driven apparatus is being urged by the fire commissioners of Niagara Falls, N. Y.



Franklin Motor Bus Used in Washington, D. C.

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PNEUMATIC TIRED BUS SERVICE.

THE General Omnibus Company of Paris, which concern's monopoly of the bus service of the French capital has one more year to run before it chooses either to supersede its horse drawn equipment with machines or abandon the field, lately commissioned a single deck 21-passenger machine for regular service, fitted with ten pneumatic tires, the rear wheels being equipped with triples and the front wheels with duals.

Another interesting feature of this machine is the location of the driver's seat, which is placed on the left hand side, the brake and change speed levers being centrally positioned. Still another novelty is the compressed air self starting device, which is also used for inflating the pneumatic tires. Exhaust gases warm the interior of the vehicle. The exhaust pipe extends vertically through the roof. It can be closed whenever necessary by the driver, thus sending the gases in the direction of the interior warming radiator.

The tires are steel studded. The machine is shaft driven. The interior is divided into three compartments, that for first class passengers located in the forward portion of the vehicle, having capacity for nine. There is room for six passengers in the second class section, while third class passengers are expected to stand on the rear platform. Class distinction of this sort in passenger transportation is well recognized abroad.

It is announced that an order for 150 of these machines has been placed with the makers, although it is not stated that the tire equipment will be of the character described. At present there are 162 motor buses in the service of the General company. Their speed is unusually high. This is partially accounted for by the desire of the operating company to compete with the electric underground transportation system. The engine of the new machine develops 20-30 hp.

MOTOR CABS IN LONDON.

AT THE close of 1908 there were 2,805 motor cabs in use on the streets of London. The principal owners were as follows:

COMPANY.	MACHINES.
General Company	1,816
United Company	422
Fiat Company	177
Express Company	70
Humber Company	50
Motor Cabs, Ltd	49
Chesham Company	24
Miscellaneous owners	197
	2,805

Of the miscellaneous owners none possess more than ten machines. Some have bought their equipment on the hire-purchase plan.

The authorities of Westfield, Mass., are considering the purchase of a motor hose and chemical wagon.

RECORD OF MOTOR FIRE VEHICLES.

ENOUGH time has now elapsed since motor driven fire vehicles were first commissioned for service in this country to form an accurate judgment concerning their usefulness. They are proven to be reliable in action and wonderfully economic in service. The losses which have been prevented by their speedy arrival at fires is, however, their chief recommendation to continued use.

The work of the two eight-men squad wagons at Springfield, Mass., is especially interesting. These machines are driven by each member of the squads in rotation. All the men are highly competent operators. During the twelve months ending with November 30 the squad A wagon has answered 210 calls and covered 1,145 miles at a total operating expense of $103.54. During the year this wagon suffered two unusual accidents, repairs for which cost $172.80, making the total expense $276.34. During the same period squad B wagon answered 225 alarms, covered 1,166½ miles at an operating expense of $99.35, and had one accident that cost $34.15, a total expense for the year of $134.15.

The chemical and hose wagon for three months, ending November 30, answered 29 alarms and covered 66 miles, at a total expense of $3.08.

These figures cover tire upkeep, gasoline, lubricating oil, oil and acetylene gas for night lamps and searchlight, polish, repairs and adjustments, and demonstrate that motor-driven wagons have been operated for 75 per cent less than the horse-drawn, besides doing four times the amount of work.

The four wagons answered a total of 1,250 alarms to November 30, with a total of five accidents. None of these accidents was serious, and no men have been injured. Total number of involuntary stops, four, a single one of which was upon the occasion of an actual fire, when the wagon was needed. In other words, one miss out of 1,250.

Motor-driven apparatus consumes from one-quarter to one-third the time necessarily taken by horses in arriving at a fire. This means that the crew is often able to tackle the blaze in its incipient stages and extinguish it by means of hand chemical apparatus. Recall within five minutes of an alarm is not an uncommon occurrence.

One of the worst fires in the history of Springfield broke out in the Mohican company's store on the morning of January 5. Seventeen firemen were overcome by monoxide gas, and had to be removed to the hospital. This was accomplished by the three motor wagons before doctors could be summoned.

The Electric Storage Battery Company is distributing a very attractive glass paper weight advertising their well-known Exide battery for electric vehicles and for ignition. One of these will be forwarded upon request to any of the sales offices of the company.

Early in May a $5,500 motor fire wagon will be delivered to the authorities of Waterbury, Conn.

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DETROIT'S MOTOR CAB REGULATIONS.

MOTOR cab rates in Detroit are fixed by law. The annual license fee for each vehicle is $10. Machines must be provided with accurate taximeters. The rates for running and waiting service are the same as those which prevail elsewhere. The following provisions of the ordinance, however, will be read with interest by those who have had occasion to observe how indifferently certain important features of service are regarded by companies operating in other cities:

"Waiting time shall include all time during which the vehicle is not in motion, beginning with its arrival at the place to which it has been called, or, if engaged in the street or at a stand, beginning at the time of such engagement; but no charge shall be made for time lost through the inefficiency of the vehicle or its driver, or for time between a premature arrival in response to a call and the hour for which the vehicle was ordered. No charge shall be made for a distance less than one mile traversed by a vehicle going to respond to a call, but for a greater distance a charge of 20 cents a mile may be made for each mile or fraction of a mile in excess of the first mile. When a vehicle is dismissed at a point more than two miles distant from the place at which it was engaged or from the place in which it was when called, a charge of 20 cents a mile may be made for each mile or fraction of a mile in excess of such two miles traversed in returning. Hand baggage may be carried by passengers without charge. Ferry tolls will be paid by passengers."

The board of public safety of Alliance, Ohio, has let a contract for the construction of a piece of motor fire apparatus which is to cost $6,394.

A motor bus and freight line is to be operated between Albany and Thompson's Lake, N. Y.

TRUCK WITH A GOOD RECORD.

VISITORS at the Chicago motor wagon show held fourteen months ago may recall a Swiss built Saurer truck which formed a part of that exhibit. This machine had a history even before it came to this country, having won first place in the German international commercial motor vehicle competition of 1907.

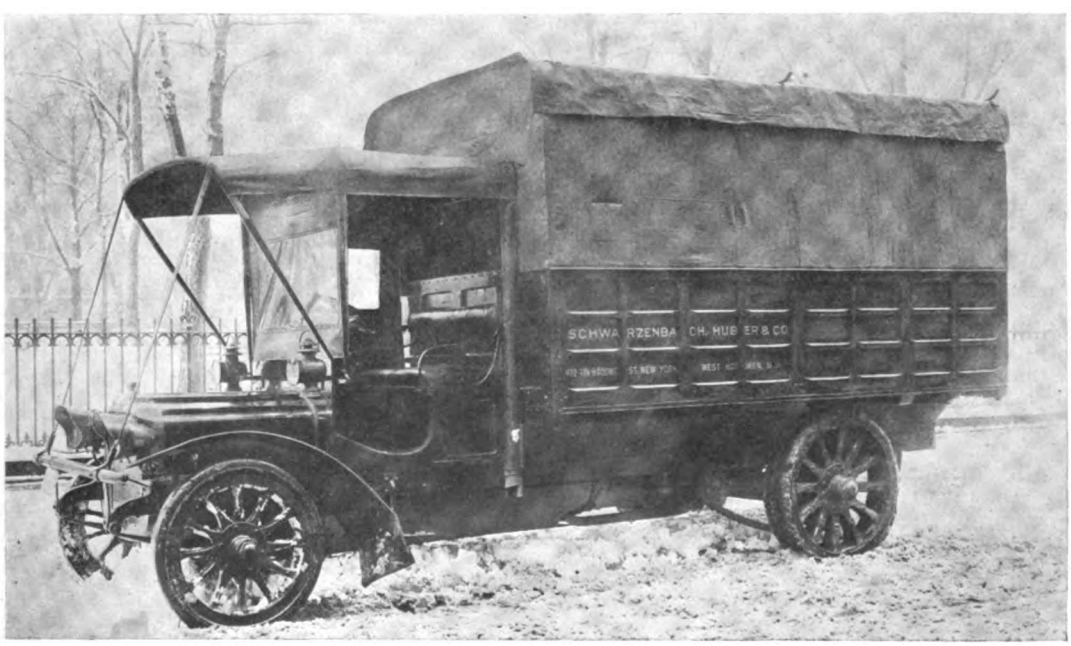
For a year past the machine has been operating in the service of Schwarzenbach, Huber & Co., of New York City, in which duty it has covered about 18,000 miles. It frequently carries five ton loads although its rated capacity is only four tons. The daily mileage fluctuates between 40 and 75. Since the truck has been in commercial service it has been twice overhauled, being out of commission upon each occasion for but a few days. The only parts replaced have been two engine connecting rod bearings, driving chains and front tires, the latter having been renewed for the first time about a month ago. The rear tires have not been changed since the machine was first put into service.

The daily expense of operating this truck, including interest on investment, depreciation, maintenance, fuel, driver's wages, insurance and storage charges, does not exceed $12 a day. The special mechanical features of the vehicle were described in the January issue of this paper.

Several motor bus lines are to be operated from Brownwood, Tex. One is to run to Mays, another to Rockwood, and a third to Mercer's Gap. A fund of $200,000 is being raised for the enterprises.

The volunteer fire company of Greenwich, Conn., has been provided with a motor chemical wagon.

The fire chief of Youngstown, Ohio, is preparing specifications for motor propelled apparatus.



Swiss Truck Employed in New York City.

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French Cabs Make No Money Here.

This announcement is made by the Ex-President of a New York Company which operates hundreds of them.

LITTLE surprise was created when it was announced by the retired president of the New York Taxicab Company, which concern operates about 600 French machines, that expenses and earnings are so evenly balanced as make its stock unprofitable to the holders thereof.

A glance beneath the surface leads one to suspect that, despite large and sustained traffic receipts, the necessity for earning on investment which is unrepresented by equipment, is proving more burdensome than was anticipated by the foreign speculators who launched the enterprise and are most deeply interested in its perpetuation. The sums spent for import duty and ocean charges already amount to a pretty penny, with the ad valorem tax on chasses and parts fixed at 45 per cent or thereabouts. Landed here vehicles cost about $2,300 apiece, which is probably $600 more than they sell for in the country of origin. This item of outlay must increase unless the company decides to buy American machines in the future, a policy not likely to be put into effect so long as the owners of the French factory wherein the present equipment is produced retain stock control of the New York establishment.

* * *

Though the capital stock of the company, not as registered in this country, but as it actually stands abroad, makes provision for this dead investment, yet it does not appear that the promoters fully realized how difficult it would be to secure and maintain the high earnings required to pay dividends. In the period preceding operations it was calculated that individual vehicle earnings would amount to $22 daily. It proves to be much less than that. Probably the daily takings do not exceed $17. This is a liberal estimate. Ample as this sum may seem to those who are unacquainted with the risks of motor cab operation, it is obviously not enough to do more than keep the service going if, as so frequently happens in the case of a novel undertaking, expense of an extraordinary and unlooked for character has to be met.

* * *

The costly strike of last fall was not on the programme prepared by the foreign capitalists who supplied New York with its first extensive gasoline cab service. The defense of its position in the wage dispute which led to that unhappy incident was conducted at great cost. It is said that the loss reached $500,000. Doubtless the proportions of the disaster are greatly exaggerated. But that it wiped out the year's profit upon operations seems quite likely. For a period of six weeks, during which there was rioting, bloodshed and great confusion in the administration of the service, the expense was very high and the receipts were correspondingly low. Profits need to be large, and the treasury well filled, in order to sustain a quarrel of this kind. Though the company eventually achieved a victory it was obtained at a cost which put a crimp in the expectations of its security holders.

Nor was this the only misfortune which was experienced during the brief period of the company's operations. Repair parts, obtained from abroad, have never been plentiful. This is partly accounted for by the desire of the management not to carry more materials than the anticipated demands of service would indicate was necessary. The difficulty and delay experienced in getting repair parts from Europe only made matters worse in this respect. This error in policy has had the evil effect of crippling the service. More machines have been laid up for repair than does credit to the administration.

* * *

The disablement of any considerable number of motor cabs in a service which is very poorly provided with spares results in the over-working of the machines which still remain in commission. The active demand for an insufficient number of cabs on the street kills the chance for leisurely inspecting and adjusting their mechanism in the garage. The executives of the New York Taxicab Company are not wholly ignorant of the truth of these observations.

* * *

Unprofitable mileage is assigned as the chief cause of loss by Harry N. Allen, who till a fortnight ago was at the head of the company. Concerning this subject, Mr. Allen says:

"We have to contend with poor roads and empty mileage. Holes in the asphalt pavements cause many breaks to the machinery. In London the average mileage per day for each car is eighty. Of this, sixty-five is full and fifteen empty. Here a cab travels on an average of forty-eight miles a day, and carries passengers over twenty-three miles only. In other words, there is no revenue derived during the run of twenty-five miles."

It need hardly be said that the extraordinary disproportion between profitable and unprofitable mileage in New York motor cab service, as related in the foregoing statement, is not to be wholly ascribed to the condition of the city's street pavements. It would be nearer the truth to say that defective administration is largely responsible for such a condition of affairs. It is even reasonable to surmise that the machines themselves might not be very well adapted for use in this country. Other motor cab companies operating in New York and elsewhere in this country, owning both domestic and foreign machines, manage to make as good a showing as the London record referred to by Mr. Allen, and this notwithstanding the fact that the streets over which their vehicles run are notoriously inferior to those found in Gotham.

It has been proposed that each New York motor cab be taxed $50 a year.

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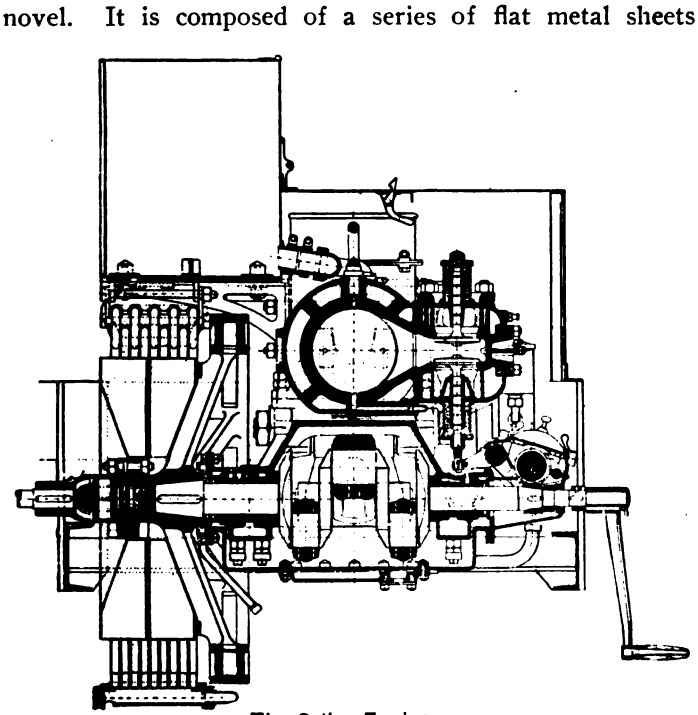
NOVEL MACHINES AT THE PARIS SHOW.

LACK of space has hitherto prevented us from presenting an account of the most interesting machines seen at the Paris exhibition held last December, which was almost exclusively given over to the display of commercial motor vehicles.

One concern exhibited a three-ton truck fitted with a four cylinder, air cooled, rotary engine which uses napthaline in brick form as fuel. These bricks are placed in a vessel, as required, and, being heated by means of the exhaust gases, are reduced to liquid form at a temperature of 60 degrees Centigrade. The engine cylinders are disposed in the form of a cross, with pistons connected to a two-throw crank-shaft. For starting it is necessary to use gasoline, and continue running on it for about 10 minutes before switching over to naphthaline. The act of opening the napthaline supply closes the gasoline flow. Lower cost of running is claimed for the naphthaline engine, the difference being said to be as great as 60 per cent. The method of converting napthaline into a solid block is kept secret by the constructors of the rotary motor. It is declared, however, that the blocks do not consist of pure napthaline, it being possible to incorporate other hydrocarbons with it without any deposit being left. An interesting feature of this truck is the method of suspension, the engine, clutch, gearset and countershaft being mounted on a subframe by inverted semi-elliptic springs in front and a single coil spring at the rear. The suspension of the mechanism is thus at all times independent of the main springs, whatever the load carried.

Greatest interest was manifested in the Soller wagon, which was equipped with a very remarkable single cylinder engine, placed transversely, in which two pistons work outwardly. The combustion chamber lies between the two pistons. The engine develops 24 hp. at 500 revolutions per minute. The accompanying illustration shows a sectional view of the engine. The radiator is quite novel. It is composed of a series of flat metal sheets brazed in pairs at their edges, eight pairs of these sheets surrounding the fly wheel.



The Soller Engine.

Every type, class and variety of vehicle was represented, in addition to which there was a thorough display of the products of establishments making parts and accessories.

THE CHICAGO SHOW.

ONLY three concerns producing motor wagons exhibited at the Chicago show. They were the Randolph Motor Car Company, The Grabowsky Power Wagon Company and the Rapid Motor Vehicle Company. As the exhibits and product of two of these establishments were described in our January issue, which contained an account of the industrial motor vehicle display at the first New York show, it is unnecessary to go further into detail concerning them.

The Randolph company showed three 1,500-pound delivery wagons equipped with different bodies. This type of machine is equipped with friction drive, a double opposed, water-cooled, 22 h.p. motor set crosswise in the frame, a 2½-inch solid rear axle, full elliptic springs, tubular front axle, 24 by 2½ inches front tires, 36 by 3-inch rear tires, and double chain drive. Strength of construction is a characteristic of the design. Ignition is obtained from a storage battery. The wheel base is 80 inches.

The company also manufactures a one-ton gasoline wagon, equipping it either with friction or sliding gear transmission. It contains the same motor as the lighter wagon, but is equipped with heavier wheels, tires and springs. The wheel base is 95 inches. This machine is provided with three forward speeds. Ignition is obtained from a storage battery.

The company's two-ton truck is fitted with a 35 h.p. four cylinder engine and selective type of sliding gear transmission. A double ignition system is provided. The transmission gives four forward speeds. In a short time the firm will place on the market 3 and 5-ton models of the same general design as the 2-ton machine, but with engine developing greater power. Since the early part of December the company has sold 60 machines, principally of the light type, including sales made to agencies established at fifteen points in the west and middle west.

MOTOR BUSES TO COMPETE WITH RAILROAD.

BEYOND Richmond, which point marks the end of the trolley line, the Staten Island Rapid Transit Company, with its steam cars, has a monopoly of passenger transportation. People living in the extreme section of the borough who wish to reach Manhattan, must pay 60 cents for the round trip. A motor bus company is being formed to give the same service for 40 cents. Its capital will be $25,000. Machines will be run from Tottenville tc Richmond, where connection will be made with the trolley cars. The bus fare will be 20 cents.

Motor bus service has been established between Pleasanton and San Antonio, Tex.

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HIGH GRADE STEEL NOT ALWAYS REQUIRED.

SOUND advice is tendered the public concerning the use of steels in automobile construction of every kind by Henry Souther, a metallurgical expert whose opinions the best engineers of the industry take pleasure in endorsing. Mr. Souther has no patience with the people who clamor for high-priced material and are unable to furnish any satisfactory reasons for desiring its employment. The most expensive steel is not necessarily the very best which might be employed for a given purpose. It is not price, but judgment used in selection, which should control the choosing of stock used for making the various parts of an automobile. Mr. Souther puts the matter this way:

"The highest-priced imported steel suitable for horseshoe nails would not do for an automobile spring as well as the lowest-priced, lowest-grade Bessemer steel made. Or, for another extreme, the best chrome tungsten tool-steel at 60 cents a pound would not make as good rivets as ordinary steel at 2 cents.

"It is not always best to use the very best, the ideal steel, for a purpose. The very best is sometimes difficult to handle commercially. Better results may in some cases be obtained by using a slightly less ideally desirable steel. This brings up the importance of handling steel.

"Much skill has always been expended in handling tool steel; it has always been regarded as most important. Not so with structural steel; and yet just as much is to be gained by handling it so as to produce a strong, tough material, capable of sustaining shock, vibration and the banging it gets in an automobile.

"Unfortunately, those who know the least about steel and its treatment are continually rushing into the public press and spreading a lot of rot about it. Such stuff is read by many who ought to know better and followed to their harm. The good steel is there just the same, waiting intelligent selection, and good cars are made by those who select wisely. But it must not be forgotten that it is possible to make a sturdy and good car with no expensive steel in it. The design must be right, however. The product will not be light. Until very recently, no steel other than simple carbon steel ever entered into the construction of the best locomotives. They did not need to be light, and long experience had produced a suitable design. Several excellent automobiles built of relatively ordinary steel, but with design and material suited to each other, exist and have done splendid work."

TEN TON TRUCK IN COAL HAULAGE.

HAULING coal by means of 5-ton gasoline machines does not seem to greatly impress the large retail coal merchants of New York City. This opinion is based upon experimental work conducted by Edward R. Hewitt with 5-ton trucks of his own manufacture. Mr. Hewitt reasons in this manner:

"On an average haul of 2 to 2¼ miles, with a 5-ton truck, we could deliver 40 to 45 tons a day. At 50 cents a ton this gives an earning of about $20 a day, which shows a fair profit, but not large enough to warrant the formation of a company for such haulage. The coalmen do not see a sufficient saving in this over their horse costs to warrant their putting in a large equipment of these machines. They state to us that their average cost is about 35 cents a ton with the large horse teams. If the motor truck costs about $15 a day to operate it would be about equal to the horses.

"The above is true of the 5-ton truck. But a 10-ton truck will show a very decided saving over the horse costs, as the expenses of operation will be not more than $1 or $2 greater, and the amount delivered will be about double. We have constructed a 10-ton truck, and I am very certain that it will show a large earning capacity over and above the horses, and will be rapidly adopted for coal hauling in New York city. New York is especially favorable for this type of truck, because of the delivery of the coal at the wharves on the two river fronts, and there are very few hauls of more than two miles from a dock. Wherever the hauls are greater than two miles, say three or four miles, the 5-ton truck would prove profitable."

MOBILIZING TROOPS WITH MOTOR BUSES.

THE usefulness of the motor bus for transporting troops is very well recognized abroad. Though for some time past army authorities have been convinced of the machine's utility in this respect, they did not until recently, see fit to make practical test of their opinion. The employment of the machine under civil life conditions, while not wholly devoid of interest for military experts, has nevertheless not helped to crystallize opinion concerning its actual value in moments of grave national emergency.

The mechanical transport department of the British army, which considering its youth is now quite highly organized, recently requisitioned twenty-four 36-passenger machines from London public service for the purpose of transporting a detachment of 500 troops from the metropolis to a point on the seaboard which, for the purpose of the "war game," was supposed to be under-garrisoned and threatened by invaders. The troops were in full marching order and took along with them three light machine guns and intrenching spades and picks. Considering the foggy weather and the sloppy condition of the roads, good time was made by all the machines, although the drivers, unused to an adventure of this sort, experienced difficulty in keeping their machines in column formation. Three repair wagons accompanied the buses as tenders.

The practical lessons learned from this experimental motor bus mobilization test are as follows: The body of the machine is not adapted for military purposes; the speed of the column should conform to that of the slowest moving machine; the repair wagons should be in the van and should set the pace; one spare vehicle should be provided for every eight or ten used in transporting troops, so that no delay will take place in conveying them to destination.

Efforts are being made to establish motor bus service which will connect Tilghman, Trappe and other towns in Talbot county with Easton, Md. It is expected that 20-passenger machines will be employed.

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REMOVING SNOW BY MOTOR TRUCK.

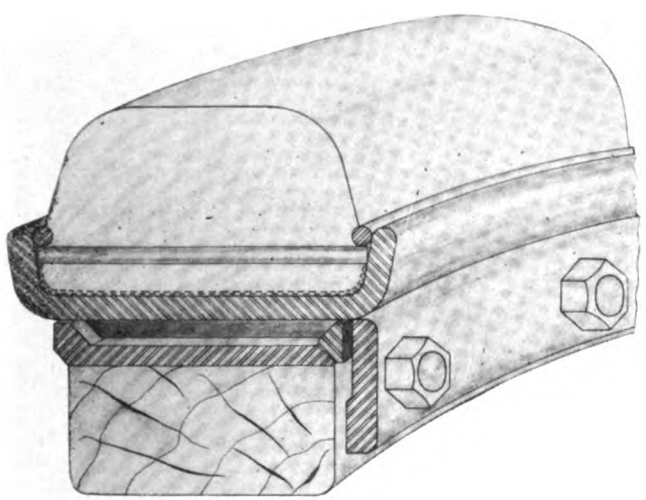
MANY ingenious methods for removing snow have come to light since the motor wagon was first introduced. But for novelty of application none equals a performance recently noted in Walla Walla, Wash.

The roof of a large warehouse was covered with twenty inches of snow, the weight of which created no slight menace. Its speedy removal was imperative. A heavy drag was quickly constructed and hoisted to the roof. It was controlled by ropes in the hands of two men. A third rope connected the drag to a two-ton motor truck on the street below. Setting the drag so that it would scrape a section of the roof from ridge to eaves, the truck was started, and in a short time the work was completed and the danger averted.

FIRESTONE'S DEMOUNTABLE RIM.

THE new Firestone side wire demountable rim was exhibited for the first time at the Chicago show. Its use effects a great saving of time in operating commercial motor vehicles. It consists of four parts, namely: the removable rim on which the tire is situated; the locking ring, having a triangular cross section, which rests between the bevelled outer edges of removable rim and the fixed base on wood felloe, which is the third part; the removable side flange which is bolted through the felloe and holds the parts rigidly in place.

This rim has no long wedge shapes, no sharp angles, and thus its parts do not adhere together from rust or



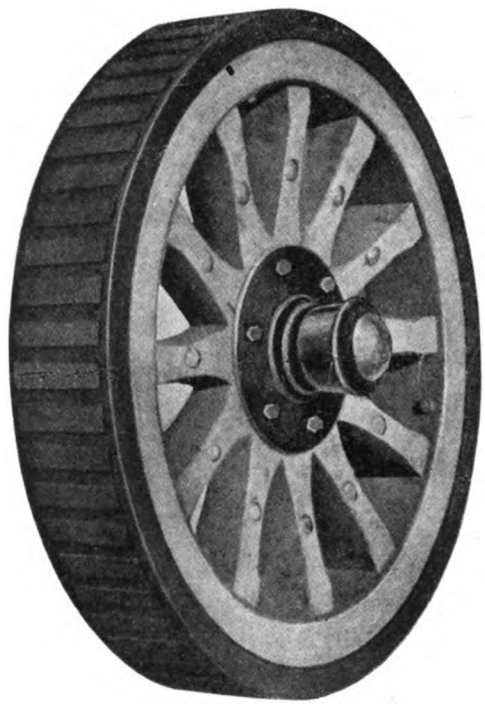
road accumulations and prevent easy manipulation.

Vehicle operators having this equipment reduce the time and effort required in changing tires and can substitute a new tire anywhere on the road. In removing the tire the flange is removed, the locking ring comes off, and the removable portion is slid off with ease. The extra rim with tire may be adjusted merely by reversing the operation.

The Business Men's Club of Memphis, Tenn., is supporting a company which is being organized to operate motor cabs in that city.

SEMI-ELASTIC NON-SKIDDING WHEEL.

THE accompanying illustration shows a wheel with a heavy cast steel tire containing 60 slots across the tread into which solid rubber blocks are inserted. This construction produces a semi-elastic wheel which does not slip or skid even on ice. The economic value of this wheel is that it is long lived. The rubber blocks with-



stand many thousand miles of hard service and of course may be replaced at small expense. These wheels are especially useful for heavy trucking over bad roads in the winter season. They are only used as drivers. They form part of the optional equipment on Saurer trucks supplied by the Commercial Motorcar Company of New York City.

BROCK HANDLING SALE OF THOMAS CABS.

DESPITE the active demand for motor cabs of all sorts and sizes few concerns making them have considered it worth while to specialize their production and sale. The business has been left to take care of itself to a very large extent. The result of this neglect has been confusion both in and out of the factory, not to mention the muddled condition of the public mind upon matters affecting investment, maintenance cost and probable earnings.

At least one producing company intends to remedy this state of affairs. The E. R.Thomas Motor Company has given Marcus I. Brock complete charge of its cab department, holding him responsible for its development and success, and not denying him the power which naturally goes with such responsibility. Mr. Brock's energy and intelligence is sure to prove beneficial. He is an experienced sales manager and factory executive. For a long time he was one of the staff of officers of the Autocar Company, leaving that concern to become assistant general manager of the Association of Licensed Automobile Manufacturers. He has a thorough grasp of the motor cab situation.

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ELECTRIC AMBULANCE FOR INDIANAPOLIS.

MANY features of the Waverley electric ambulance purchased for the Indianapolis board of health make that vehicle quite unique. The frame is of armored wood, with motor, battery and steering apparatus attached to same and independent of the body. An exceptionally powerful motor is provided with large overload capacity, such as is used on commercial vehicles in heavy service. This motor is operated by a 42-cell, 13-plate battery. The vehicle speed varies from 3 to 15 miles per hour in ordinary service, with a special emergency speed of 20 miles per hour. A four-speed controller, so designed as to enable the car to start and accelerate without shock, is an important feature of the equipment from the patient's point of view. As a matter of fact, the comfort of the patient and the dependability and serviceability of the machine have been studied with the minutest care in every particular.

The body is 8 feet long by 3 feet 10 inches wide inside, and has two hinged seats that may be folded against the sides of the ambulance when stretchers are used. When stretchers are not in use they will be suspended from the top. Under the driver's seat, besides drawers for supplies, space is provided for an electric heater. In the interior is an electric light. Three windows are provided, all furnished with silk curtains.

Buffalo's postmaster is preparing to make some experimental tests of the motor wagon in mail collection and distribution.

The Boston fire department has received authority to add a motor driven chemical engine to its equipment.

A four wheel driven motor police patrol wagon has been bought for use in Duluth, Minn.

The use of motor wagons in the Pittsburg postal service is being very attentively considered.

Two steam motor ambulances will be bought for the Baltimore fire department.

"FRONTANAC" TRUCKS.

POWERFUL and well designed gasoline trucks are being made in three sizes by the Abendroth & Root Mfg. Company, of Newburg, N. Y. The ratings of the models are fixed at 3, 4 and 5 tons. All models have a large overload capacity. The 5-ton model, of which the others are but diminutives, is driven by a four cylinder, four cycle, water cooled engine developing 40 hp. Double ignition system is provided. The transmission is of the four speed selective sliding gear type. The cone clutch is of the leather faced variety. Final drive is accomplished by means of side chains from a jack shaft. The wheel bearings are of the annular ball type. Back of the driver's seat the chassis measures 12½ feet. The wheel base is 126½ inches.

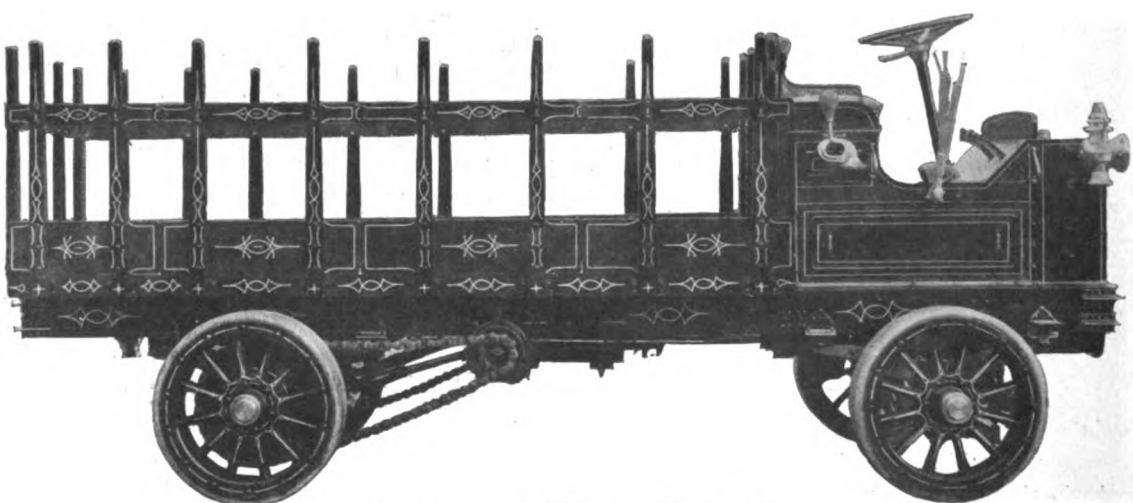
INTERESTING MOTOR CAB DECISION.

HAVE hotel motor cab proprietors the right to hire out the service of their machines to any but regularly enrolled guests of the establishment? The point at issue was recently decided in the affirmative by a judge in Washington, D. C., who declared that anybody who ate a meal or got refreshment of any kind in a hotel was just as much under its protection as though he leased one of its apartments. For some time past complaints have been numerous concerning the piratical tendencies of motor cab proprietors. Not only have they obtained exclusive hotel privileges, but they also insist upon putting machines on the public ranks, much to the disgust and loss of the horse cab drivers and owners.

For the purpose of connecting Barstow, Tex., with the Orient railway, by means of motor bus, the local commissioners' court has been petitioned to order the construction of a bridge across the Pecos river.

The Cincinnati police officials recently tested the advantages of motor patrol wagon service with the object of recommending its installation.

A machine to carry a crew of five and emergency tanks is required by the Fitchburg, Mass., fire department.



The "Frontenac" 5-Ton Gasoline Truck.

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THE GIBNEY WIRELESS TIRE.

THE new Gibney wireless tire for commercial motor vehicles, now being manufactured by James L. Gibney & Bro., of Philadelphia, is not only a European idea but a European fact. The tire was first introduced there about five years ago, and its subsequent history has been one of such efficient service and increasing popularity that it is now the European standard. Its introduction here is due to James L. Gibney's recent visit to the continent, where he found it in very general use. In this connection Mr. Gibney says: "Three years ago when I went abroad, this wireless tire was just beginning to be used. At that time, however, the dual side wire type had just been introduced and was having the run of popular favor. But this year, when I repeated my visit, I was impressed with the strides this wireless tire had made. There seemed to be nothing else on the exhibition trucks at the Paris show. I also noted that in Paris and in London all the large bus companies had adopted it exclusively as a tire equipment. Inquiries proved to me that it had almost supplanted the side wire type. I resolved at once to introduce it here."

The tire takes the name "Wireless" from the fact that no wires whatever are used in its construction or in applying it to the wheel. The construction also differs from that of the side wire and other types in that no channel is used, the tire being applied directly to the wheel, with only a steel band intervening. The tires are moulded with a metal base which is securely interlocked with the rubber in the tire. The fact that there is a thin cushion of hard rubber on the under side of the metal base insures an absolutely tight fit and a secure hold on the band. The tires may be applied either single, double or triple, as the weight of the vehicle may demand.

Gibney & Bro. state that the new tire will be ready for delivery in a few weeks. Blue prints, price lists and descriptive literature are being prepared in the meanwhile. The guarantee which will be given with this tire will be a very agreeable surprise to American truck owners and manufacturers.

For several years a motor bus service has been operating out of San Juan, Porto Rico. It has proven so satisfactory to the people on the section through which the cars have been run that they are thoroughly converted to this means of transportation. This was proved by the fact that when a new company was recently proposed the capital stock was oversubscribed many times by the merchants.

Wichita, Kan., has been supplied with a motor police patrol wagon.

The Auto Transit Company of Wyalusing, Pa., has been formed with capital stock of $5,000.

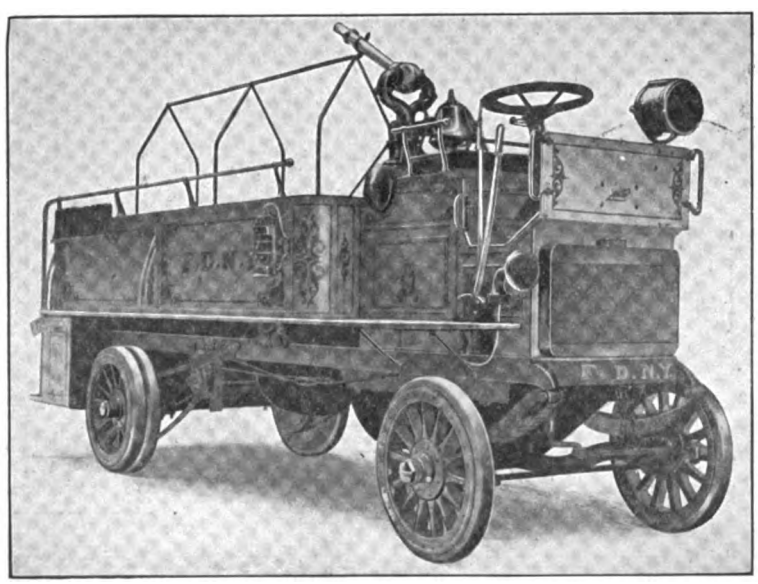
An $8,000 automobile fire engine is on its way to Alameda, Cal.

Says the chief of the Minneapolis fire department: "The great trouble with fire department automobiles today is that, while some of the best I have seen are capable of traveling at a high speed, when they reach the fire they are not capable of developing half the water pressure that can be obtained from my best engines."

An appropriation of $3,500 is expected for the purchase of a motor chemical wagon for Fall River, Mass.

A steam driven police patrol wagon, costing $4,500 and seating twelve passengers, has been bought for Omaha.

The Savoy Taximeter Cab Company of Far Rockaway, N. Y., has been organized to provide service in the Rockaways.



Knox Machine Used in New York Fire Department Service, Fitted with Hartford Tires.

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LOCKPORT RUBBER WORKS' TIRE.

DESCRIBING construction of almost every kind without the use of explanatory drawings is an obligation from which the publisher of a trade paper would willingly be excused. In our September issue we undertook to show the construction of the heavy duty truck tire made by the Lockport Rubber Works, and with the materials at command did all that was possible. Now, however, the makers have supplied us with a complete set of drawings which makes the construction much clearer.

The tire is made in endless sections as shown in Fig. 1, which represents the four sections needed in order to make a tire with an 8-inch tread. Fig. 2 shows one of these endless sections of rubber with cross rods inserted loosely therein, and the first circumferential wire placed over the cross rods. Each additional endless rubber section and circumferential wire is added until the required size of tire is built up. Fig. 3 shows side flanges, with holes in the lower part for felloe bolts and depressions in the upper part into which the cross rods fit. Fig. 4 shows a tire with 8-inch face assembled and ready to be drawn together by screwing up the felloe bolts. Fig. 5 shows the rubber compressed sidewise by tightening of the felloe bolts. This closes up the sections, forces the rubber to hug the base, makes the cross rods enter the slots in the flanges, and fashions the whole into one compact and securely attached tire. Fig. 6 shows the complete tire and the only tools necessary for repairing or dismounting. A whole section of the tire, or any part of it, can be replaced or repaired on the road in an hour's time. The fastening method allows the rubber to wear down to the flange.

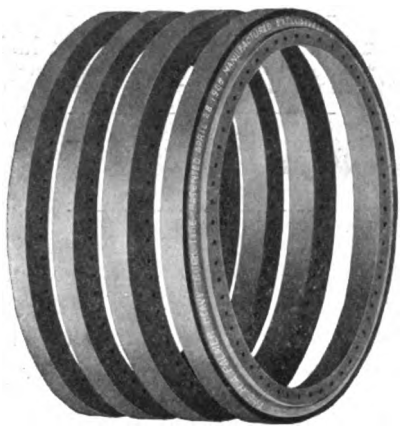

Fig. 1.

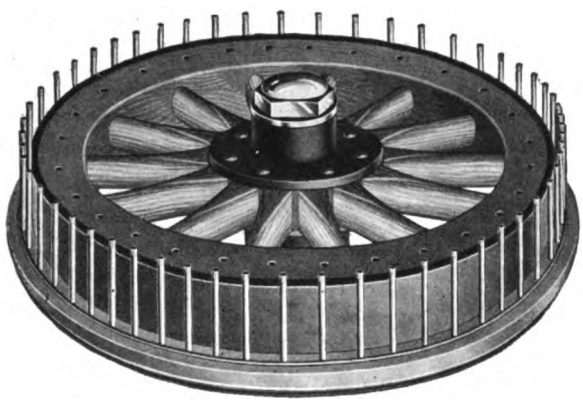

Fig 2.

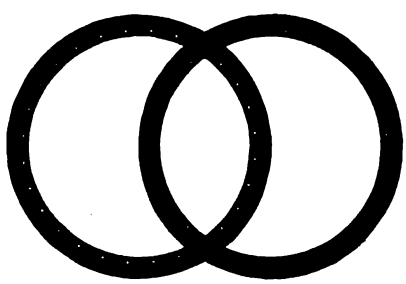

Fig. 3.

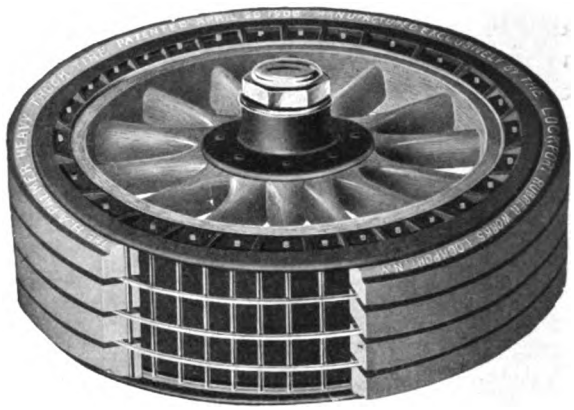

Fig. 4.

Fig. 5.

Fig. 6.

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CHANCE FOR MOTOR BUS ENTERPRISE.

THE auto omnibus has not yet reached Albany, but it is sure to come, and the enterprising capitalist who first establishes lines connecting this city with the towns to the west of us that are not reached by railways will reap a rich harvest in the summer season. Auto bus lines are to be established between Schenectady and South Schenectady and Burnt Hills next spring, and no doubt will be well patronized. In the first place, thousands of Albanians who are not financially well enough off to own automobiles would patronize the auto busses simply for the pleasure of riding in a novel vehicle. In the second place, such good time can be made with these vehicles that a dash of twenty miles out into the country on a pleasant summer day could be taken by any business man without neglecting his duties. That the auto bus lines connecting this city with towns and villages between the Hudson river and the Helderbergs that are now reached only by stages would bring much trade to Albany merchants is self-evident. In fact, the leading merchants of this city would find it profitable to organize a company for this very purpose. It is practically certain that the investment would pay from the start, to say nothing of the increase in business the merchants would enjoy.—*Albany (N. Y.) Knickerbocker.*

TRUCK TIRE CATALOG.

COMMERCIAL motor vehicle users who may wish to know something of the construction and variety of solid rubber tires can gratify their desire by glancing through the little book recently issued by the Diamond Rubber Company. Though the publication necessarily deals quite extensively with the Diamond company's own product, yet it contains a lot of information which could be advantageously absorbed by tire buyers. The value of resilient tires is admirably treated in the book.

PACKARD TRUCK CATALOG.

THE Packard Motor Car Company, of Detroit, has issued a catalogue descriptive of its 3-ton gasoline truck. The fore part of the book is given up to an exceedingly interesting analysis of the various services in which the machine will and will not perform to advantage. Many highly interesting observations upon the general subject of motor wagon transportation are also presented.

CHANGES IN STANDARD ROLLER BEARING CO.

RECENT changes announced in the executive department of the Standard Roller Bearing Company, of Philadelphia, are as follows: Frank M. Germane, formerly sales manager, appointed assistant general manager of the company; Thomas J. Heller, appointed sales manager; F. W. Lawrence, appointed western representative, with headquarters in Chicago.

The Walter Hale theatrical company is being transported by motor bus in its migration through the east. The baggage of the company is carried by rail.

ADDITION TO THE "AMERICAN" FAMILY.

MANY points of interest are observable in the last model to issue from the shops of the American Motor Truck Company, of Lockport, N. Y. The machine, which is classed as a light delivery wagon, is rated to carry 2,000 pounds. It is fitted with a four cylinder, four cycle, water cooled engine developing 22 to 25 hp.

The frame is of hardwood, with cross members of the same material mortised in the sills and half-inch iron

rods running through and binding them together. The corners of the frame are braced with angle iron and bound with steel armor plate.

The front axle is of I-beam section. The rear axle is square, dead. Both axles are fitted with roller bearings. The tire equipment is 32 by 3 inches all around. Jump spark ignition is supplied. The clutch is of the cone type, leather faced. Sliding gear transmission provides three forward speeds. The gears, of nickel steel, are of 6 pitch and one inch face. The final drive is accomplished by means of side chains running from sprockets on the jack shaft. Internal expanding and external band brakes are fitted. Lubrication is accomplished by splash and force feed systems. The useful road speed of the machine may be varied from 10 to 15 miles an hour. The wheel base is 102 inches. The length overall, approximately, is 144 inches. The width overall is 57 inches, and the tread is 56½ inches. The fuel tank holds 8 gallons.

BIRDSALL AGAIN A CONSULTING ENGINEER.

ONCE more E. T. Birdsall is a consuling engineer and designer, with headquarters in New York City. He will specialize the design and operation of commercial motor vehicles. He is also prepared to give advice to customers desiring to buy machines.

The volunteer fire company of Jenkintown, Pa., is raising a $5,000 fund to buy a motor hose and chemical wagon.

The Commercial Truck Company, of Albany, N. Y., has been organized with capital stock of $10,000.

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Wagon Maintenance

Tips to new drivers and caretakers about things likely to escape their attention

THE most insidious enemy of a ball bearing is rust. Were it not for the extreme accuracy of the balls themselves, which are rejected in some factories if they vary from a truly spherical shape more than one ten-thousandth of an inch, they would not be capable of annihilating friction to the extent they do. And also if less care were exercised to insure the precision attained there is but little doubt that troubles would arise continually. A fair criterion of this may be noted in the damage which a trivial amount of rust will engender. Once let rust attack the polished surfaces of balls or races and the corrosion will soon result in the destruction of the bearing. For this reason ball bearings should never be run dry. Grease and oil not only act as lubricants but also prevent rust from attacking the steel. The oil used too must be perfectly free from acid, as this will corrode the bearing. Hubs are best stuffed full of vaseline, because this helps keep out damp, and as these bearings revolve comparatively slowly in the road wheels a thick lubricant answers just as well or better than a thin one. It may be taken generally that the lighter the load and the higher the speed the thinner should be the oil which is used for balls.

* * *

Results of Non-Lubrication.

Mysterious noises emanating from the running gear usually denote a want of lubrication in the springs or universal joints. When the springs require lubrication, and no grease channels are provided, the frame should be jacked up to remove the weight from the leaves, and grease introduced between them, by means of a knife blade. Oil also should be used, as it will penetrate into inaccessible crevices and is not liable to be forced out between the leaves, when the weight of the car is placed on the springs.

* * *

Care of Multiple Disc Clutches.

When wagons are equipped with multiple disc clutches there is sometimes difficulty experienced in starting after the machine has been standing for a time, as the pressure of the springs forces the plates together to such a degree that they do not let go readily when the clutch pedal is depressed, making gear shifting somewhat ticklish. This tendency may be obviated by applying a mixture of kerosene and thin oil to the clutch, which now may be inclined to slip, and to counteract which thick oil should be added until a positive grip is secured.

* * *

Cleaning Out Gear Cases.

Very few take the trouble to thoroughly empty out and wash the interior of gear-boxes and crank cases, and yet heaps of metal is worn off the teeth of wheels sometimes. The particles that wear off the teeth of gears are glass-hard, as a rule, and form an abrasive powder that, mingling with the oil or grease, attacks the bearings and axles, besides assisting to further demolish the teeth from which it has been detached. A systematic and frequent emptying and sluicing out of gear-boxes, differentials and crank-pits is a practice much to be commended, and it should be done before fresh lubricant is added, so as not to waste more than is necessary. It is possible, where rigid economy is studied, to utilize the oil or grease again by warming it sufficiently but gently until all the dirt settles at the bottom. In the case of oil the clean portion can then be decanted, and, as an extra precaution, filtered, but it should be borne in mind that oil, however carefully cleansed, cannot be used to advantage indefinitely, for it loses its lubricating properties in a very noticeable degree; in fact, one can feel the difference between fresh oil and that which has been used some little time by merely rubbing it between the fingers.

FRAYER-MILLER THREE TON TRUCK.

HASTE in compilation led to the incorrect classification of the gasoline truck made by the Oscar Lear Automobile Company, of Springfield, Ohio, in the tables recently presented in this paper. The company's machine was listed along with vehicles of 5,000 pound rated capacity. It should have been listed in the three ton class.

DEMONSTRATING MOTOR FIRE APPARATUS.

DURING the past month motor propelled fire apparatus of one kind and another has been demonstrated at the following points: Plainfield, N. J.; Norristown, Pa.; Allentown, Pa.; Peekskill, N. Y.; Newburgh, N. Y.; Yonkers, N. Y.; Hackensack, N. J.; Newark, N. J.; New Castle, Pa.; Elizabeth, N. J.; Fall River, Mass.; Worcester, Mass.

A feature of the service to be furnished by the St. Louis Taxicab Company is the hiring of the machines by the month or longer. Parcel delivery will also be undertaken. The officers of the new company are Charles C. James, president; John M. James, vice president; John H. Phillips, formerly of the Mississippi Valley Automobile Company, manager.

A fund of $5,000 is being raised by one of the volunteer fire companies of Wilkesbarre, Pa., for the purchase of motor driven fire apparatus.

The New Haven, Conn., Taxicab Company has been formed with capital of $25,000.

The authorities of Enid, Okla., have decided to buy motor driven fire apparatus.

The 800 motor cabs in New York City are doing 60,000,000 tire miles a year.

Early in March motor cabs will be operating in Lexington, Ky.

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Mitchell

MOTOR TRUCKS

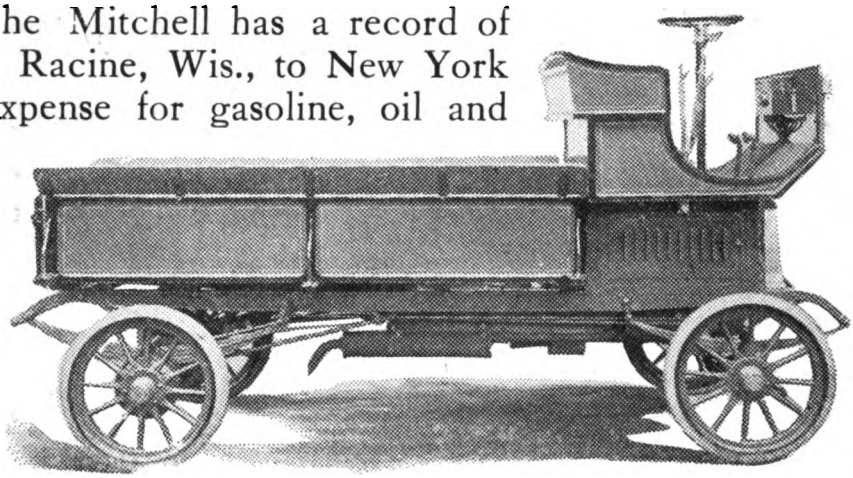
Are kept to the Standard of the Famous Mitchell Pleasure Cars

Note the Facts Before You Decide Which is the Best Truck

THE question is—Do you want the truck that has proven its value beyond any doubt on the road or the truck that bases its claims for favor on simply what it *should* do?

Remember, the Mitchell has a record of 1,169 miles from Racine, Wis., to New York for which the expense for gasoline, oil and grease amounted to but $39.40.

The average mile cost but 3⅓ cents and no truck ever traveled such roads before. Remember, too, this truck carried 50% overload as the truck is of one-ton capacity and the load was 3,400 lbs.



4 Cylinder, 20 H. P. Capacity One and One-Half Tons

Let Us Give You Details

Ask us to prove this truck best to your entire satisfaction.

Learn how it's made and why made that way.

Ask us all of your questions.

Let us answer with a wealth of evidence that will convince you at once.

NOTE THESE SPECIFICATIONS:

Wheel Base	110 inches	Engine, 4-Cylinder, Vertical	20 H. P.
Tread	56 inches	Ignition, Magneto and Dry Batteries.	
Wheels (front) Solid Tires	30x3 inches	Transmission, Sliding Gear, Three Speeds and Reverse.	
Wheels (rear) Solid Tires	30x3½ inches	Carrying Capacity	1½ tons
Body, Width (inside measurement)	3 feet, 7 inches	Axle (front) I-Beam. Axle (rear) Worm Drive.	
Body, Length (inside measurement)	8 feet	Weight of Truck, Complete	2,300 pounds
Body, Depth (inside measurement)	14 inches		

PRICE, $2,000

WRITE FOR FULL INFORMATION

The Mitchell Motor Co., 564 Mitchell St., Racine, Wis.

Standard Manufacturers A. M. C. M. A.

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SENTIMENTAL GUSH.

ANTICIPATING the time when horses will disappear entirely from fire department service, a number of country journalists are fairly watering their pages with sad expressions of regret for the "superb horses," the "dappled steeds," the "noble beasts" and the "satin-coated pets" of the service. Sentiment of this character may be an indication of the purity of the country editor's heart, but it does not increase our respect for his horse sense. The saving of human life and property is immeasurably more important than the retention of inefficient animals, however splendid their proportions or color. Sick minds invest the fire department horse with poetic qualities he is very far from possessing. He has always been more showy than useful. In action he is in the air half the time. His speed is much less than is generally realized. So long as his services are retained fire losses, human and material, will be higher than they should be.

Motor bus service has been established between Redlands and Highland, Cal.

TO BUILD FOUR-WHEEL DRIVE WAGONS.

LIGHT four-wheel-drive gasoline wagons will be manufactured in Mankato, Minn., by the Four Traction Auto Company. The machines will have a load capacity of 3,000 pounds. It is a little more than two years since a machine of this type has been seen on this market. The driving principle is unquestionably sound from an engineering point of view. It is especially valuable where traction is difficult. The total weight of the Mankato machine is 3,200 pounds. For some time past demonstrating models have been seen at various points in the state of Minnesota, one having traveled from the factory to Minneapolis, a distance of 112 miles, in 12½ hours, for the purpose of showing what the machine could do. Gasoline engine power is employed.

The Taxicab and Automobile Co., of Kansas City, has been organized with capital stock of $10,000.

Efforts are being made to establish motor bus service between Bridgeton and Salem, N. J.

"AMERICAN" DELIVERY WAGON

This Is The "AMERICAN" Delivery Wagon

Its Capacity is 2,000 Pounds

It possesses the same high quality as our

TRUCKS

with capacity from 2 to 5 tons.

Before you can be assured that you have obtained the most reliable and economical machine on the market you must invest in an "American."

Stages and Sight-Seeing Cars

Electric as well as Gasoline.

We make them all in our own plant. That is your guarantee that they are not assembled from parts purchased by concerns which know little or nothing of motor wagon manufacture or use. **Send for our Catalog—A 59.**

AMERICAN MOTOR TRUCK CO., Lockport, New York

ATTRACTIVE ARRANGEMENTS CAN BE MADE FOR RENEWALS FOR "Exide" VEHICLE BATTERIES

THE GENUINE "EXID_" PLATE HAS "EXIDE" MOULDED ON THE LUG AND IS MANUFACTURED BY

THE ELECTRIC STORAGE BATTERY CO. PHILADELPHIA

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The Power Wagon

A Journal for Those Employing Commercial Motor Vehicles

No. 53 APRIL, 1909 No. 53

PUBLISHED THE FIRST OF EVERY MONTH BY

THE POWER WAGON PUBLISHING CO.

SUBSCRIPTION RATES:

One Year (Domestic)	$2.00
One Year (Foreign)	3.00
Single Copies	.20

PUBLICATION OFFICES:
THE METROPOLITAN BLOCK
Chicago, Illinois.

Advertising Rates on Application

WALTER WARDROP, Editor

Entered as Second-Class Matter December 2, 1907, at the Postoffice at Chicago, Ill., Under the Act of Congress on March 3, 1879.

Import Duty Not to Be Changed

The existing tariff on motor road vehicles of all kinds to remain at 45 per cent. ad valorem.

UNLESS the senate slights the recommendation of congress there will be no reduction in the tariff affecting the importation of commercial motor vehicles. The probability of such defiance being extremely remote, there is thus held out the comforting prospect of maintaining the 45 per cent tax barrier while American manufacturers are developing the resources of their own market.

A feeble effort was made to have the tariff lowered, but the arguments advanced in favor of such a policy did not appeal to the house committee on ways and means. Opponents pleaded the youth of the industry, asserting that it demanded all the political mothering which it was possible for our national legislative bodies to extend.

* * *

One has only to study the recent trade history of England in order to know how difficult and perilous it is to recover possession of a home market which, at the outset of a new commercial development, is delivered over to every aspiring invader. For years the British pleasure and commercial motor vehicle market was overrun by foreigners. To such an extent did European product find its way across the channel that the natural hope of creating a native industry was almost strangled. Hundreds of millions of dollars went to France for touring cars, buses and cabs, and the flow is not yet checked. The art of manufacturing such machines was old in Europe ere it was cradled in England, and if trade historians have not lied the latter country has been persistently used as a dumping ground for surplus stocks. With such a condition arising from inadequate protection in a land where wages are almost on an equality with the low scale which prevails in Europe, it is small cause for wonder that an alert congress could not be tempted to duplicate it in America, where the wage rate is very high. The tariff remains unchanged as a protection to our workingmen and the industry.

Just consider how the French motor cab multiplies and flourishes in our large cities. And this in spite of the prevailing import duty. Their presence here is merely the result of native underproduction. A reduction of the tariff at this moment could only serve to stimulate the importation of such machines.

* * *

Development of the home market for the benefit of home consumers and producers has for a long time been a cardinal feature of political administration in the United States. Nor is it likely that this doctrine will undergo change so long as there are industries to be encouraged and competitors to be denied.

One of the most interesting features of the new tariff measure is the treatment proposed for foreigners who obtain patents in this country. Manufacture must be undertaken, or else the protection which a patent affords will be forfeited.

PHILADELPHIA BUS SERVICE TO BE RENEWED.

LITTLE has been heard of the intentions of the Auto Transit Company, of Philadelphia, since the stoppage of its electric bus service last summer. It is now officially stated, however, that operations will be resumed within three weeks along North Broad street, and it is also probable that travel on South Broad street will again be reestablished.

Six motor buses, each with seating capacity for 24 passengers, are to be put in service in Springfield, Mo. A company with capital stock of $25,000 is being formed to conduct the enterprise.

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MOTOR TRUCKING IN THE COUNTRY.

OWNERS of large estates and farms are beginning to perceive how advantageous it is to make use of the motor wagon in hauling produce to market and in carrying supplies therefrom. The time element is just as important in agriculture as it is in any other branch of industry, and the labor of horses is proved quite as wasteful in the country as it is in the city.

Wherever there is a farming region which can boast of good roads the motor wagon can find a place to demonstrate its usefulness and economy. Proof of this assertion is being afforded with rather considerable frequency nowadays. Fruit growers of the west, private estate owners in the east, and market gardeners who cultivate tracts of land lying outside of large cities are now tolerably well acquainted with the machine and use it with gratifying success.

There is a 1,500 acre estate nine miles from Greenwich, Conn., which like all properties of its class is largely cultivated for revenue. It is known as Conyers Manor and is owned by E. C. Converse. Everything about this property indicates the high value which is attached to scientific methods of administration. There is a well equipped garage for the propietor's touring cars and runabouts and a separate building for the four industrial machines which it is proposed to employ. The nucleus of the latter equipment is a 3-ton Packard truck. This machine plies with much frequency between the estate and the town. Inside of its stake platform a body for the carrying of grain is inserted. When this grain carrying body is not required it is removed, and the stake platform is then available for the loading of fertilizer, coal, machinery and general farm and house supplies. The length of the hauls, the infrequency of stops, and the activity of the service in which this machine is employed combine to make its work particularly valuable.

THE NOMENCLATURE OF BUSINESS VEHICLES.

THE indiscriminate use of the word "automobile" as a descriptive term for motor road vehicles of every sort jars the sensibilities of those who understand how important it is that there should be no confusion of family types. The mischief which lurks in such practice is pointed out in the following protest:

"How long must the motor truck continue to be at a disadvantage in being labeled an 'automobile'? Without question it would be of considerable benefit if all connected with the commercial motor vehicle industry would abandon the use of such a term. There is no more sense in calling a motor truck an 'automobile' than there is in applying the term 'speed launch' to a powerful ocean going tug. Much of the confusion which prevails is caused by inexperienced writers who consider the word interchangeable in describing pleasure and commercial machines. This unhappy choice in diction is constantly encountered in trade organs which occasionally aim to say a good word for the business machine. Quite a lot of money has been spent for 'automobiles' which should have been laid out for motor wagons. Such investment is represented by converted touring cars or runabouts. The business man in search of information concerning the economy of the motor wagon will do well to be on his guard against the salesman who entertains him with a discussion concerning 'automobiles.' C. E. STONE."

Philadelphia.

The Smith & Nixon Company, piano dealers in New York City, state that their 2,500 pound electric wagon effects a monthly saving in transportation varying between $50 and $100.

The authorities of San Diego, Calif., are about to purchase a motor hose and chemical wagon.

Packard truck used on the Converse estate to haul grain, coal, fertilizer and general supplies.

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A WELL MANAGED GARAGE.

COMMENT has frequently been made in this journal upon the skill shown in maintaining the Anheuser Busch Company's extensive motor wagon service. The garage is 250 by 150 feet. It is located at the corner of Broadway and Wyoming street in St. Louis. Besides the 58 electric and gasoline delivery machines, this building also affords storage room for 14 large and small cars which are retained for the private and commercial needs of the heads of departments. The most interesting of the private service machines is the coach made by the Pope company and publicly exhibited in the winter of 1907. Many wealthy men desired to obtain possession of this roomy and luxurious vehicle, which is fashioned after the style of the English coach of by-gone days. Augustus Busch bought it for $10,000.

The garage is equipped with a complete machine shop, containing lathe, gear cutter and drill press, besides all kinds of hand tools. The company practically turns out its own parts in this shop. The garage proper has two pits. In them are hydraulic jacks capable of lifting five tons. In its own wagon works and machine shop the company has built seven complete electric trucks within the past three years. The garage has a switch board with fifty-five individual charging rheostats, equipped with separate ammeters and circuit breakers. Here every evening trucks are recharged. The five ton trucks cover twenty-five miles on one charging; the one and one-half and three ton delivery wagons, thirty-five miles on one charging.

The system for keeping track of the regular charging of electrics and the necessary repairs on them is highly perfected. While the operating cost per motor truck is higher than that of a large delivery wagon drawn by horses, yet from the fact that the company secures more mileage and speed, and can carry heavier loads, it is figured true economy to use the machines.

Henry Menzenwerth, general superintendent, uses a little electric runabout in driving to the various departments of the brewery. The brewery's property covers 70 city blocks.

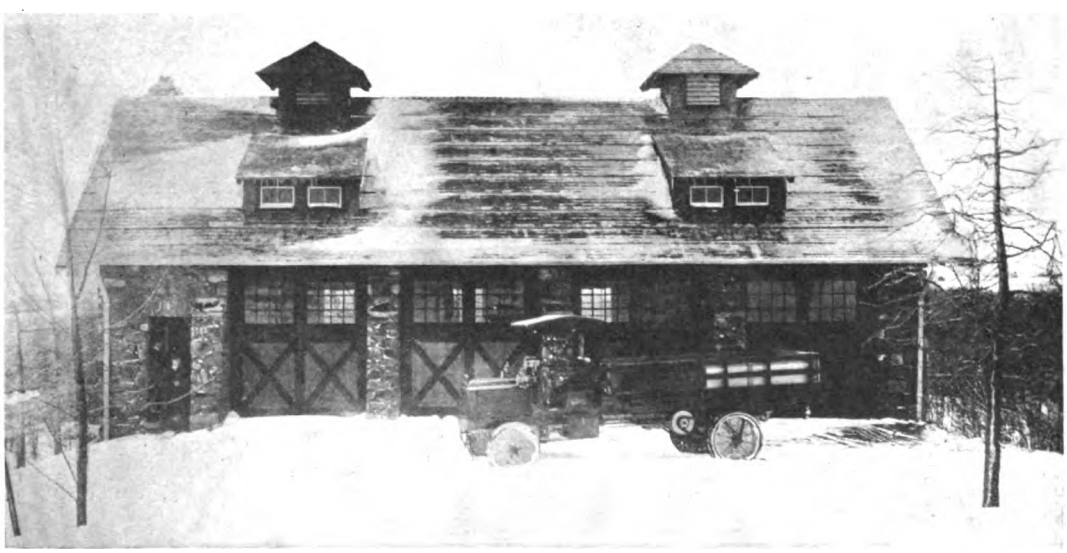
MOTOR CAB SERVICE OF THE FUTURE.

MOTOR cab service of the future will be very unlike that which we witness today. The haste of manufacturers and operating companies to get into action has resulted in a condition of affairs which, despite public criticism, is not likely to undergo any marked change unless municipal authorities and investors coöperate intelligently for the improvement of the service.

The shortage of vehicles, and the eagerness of the public to patronize them, has resulted in a condition which could have easily been foreseen. Prices are high and inequitably adjusted to service rendered. It costs as much to ride in a badly designed machine as it does to hire one which might be considered as representing engineering excellence. The tariff apparently is not regulated by the quality of the service or the investment. In whatever large city one finds himself the sum of thirty cents is exacted for the first half mile, without regard to the cost of the vehicle, its smoothness of operation, its furnishings or its cost of maintenance.

Manifestly the tariff should be equated to the investment, the engineering and the cost of administration. Existing fares should apply only to the most luxurious and best designed vehicles. There should be lower fares for single cylinder and two cylinder machines, as well as for those which are of the two cycle engine type.

It is high time to publicly indicate the various classes of machines in order that the hirer shall not be confused in distinguishing them. A foreign manufacturer of motor cabs has suggested that a large figure displayed in front of the engine hood would readily denote how many engine cylinders were concealed underneath it. Similar numerical designation might convey information concerning the engine power. It has also been proposed, under a readjustment of conditions, that all machines be painted one color and that the door panels be used for the display of the various operating companies' commercial signs or marks. Obviously the purpose of painting all public service vehicles one color is to sharply distinguish them from other vehicles of the same general type which may be used either in private or semi-private service.



Building on the Converse estate near Greenwich, Conn., in which motor trucks are stabled.

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GASOLINE-ELECTRIC WRECKING WAGON.

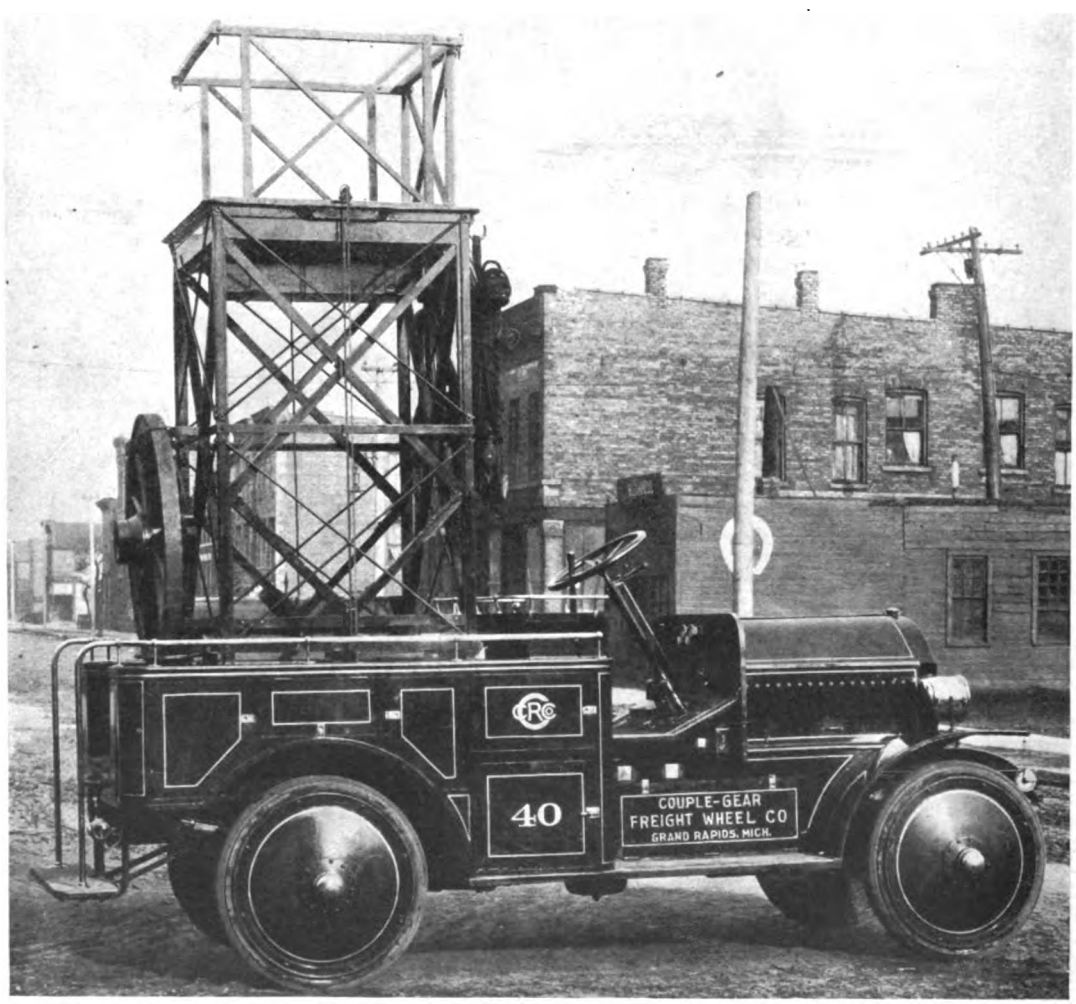
THE scarcity of gasoline-electric vehicles alone would justify public curiosity in their work performances even if there was no other reason for regarding them with attention. The enthusiasm with which the Couple Gear Freight Wheel Company has championed this type has created a very active inquiry for information concerning its advantages, and in a number of instances has resulted in the placing of orders. The Chicago City Railway Company, for example, recently purchased a machine of the kind under consideration. Although it is officially known as a wrecking wagon, it is employed in emergency duty of all kinds. The tower is telescopic, enabling the crew to repair overhead construction. When the tower is not raised the machine may be used in clearing the track of disabled wagons, derailed cars, etc.

In placing the order with the Couple Gear Freight Wheel Company the purchasers only stipulated for a speed of 20 miles an hour and an ability, on the part of the machine, to haul off the tracks and out of the way a wagon which might have one wheel removed and a skid placed under the axle, the total weight of the disabled vehicle and its load being calculated at 20,000 pounds. In the course of tests the machine easily fulfilled these requirements and was accepted and paid for. It is kept in the company's garage at 20th street and Wabash avenue, and is on duty throughout the whole course of the day.

The wheels, steering knuckles and axles are of the Couple Gear company's standard type. The tread of the vehicle is purposely narrowed in order to fit the spread of the street car rails. Power is derived from a four-cylinder, four-cycle engine, which is connected direct to the armature of a 10-kw. generator. The operator is enabled to secure any engine speeds ranging from 100 to 1,500 revolutions per minute. This affords great elasticity in the voltage and road speed of the machine. In addition to the changes of road speed secured in this manner other variations are obtained by means of the controller. Current flows direct from the generator to the controller, and is there distributed to the motors in all four wheels. The total weight of the machine is 9,150 pounds. The engine develops 35 hp.

Efforts are being made to establish motor bus service between Niagara-on-the-Lake and St. Catherines, Ontario. Virgil, Queenstown and Homer are points on the proposed line.

Horse-drawn cabs are not permitted to stand in front of Detroit's hotels. Motor cabs are granted this privilege. Such discrimination causes much ill feeling between the owners and drivers of each type of vehicle.



Gasoline-electric four-wheel-drive emergency wagon used by the Chicago City Railway Company.

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Immense Economy of Gasoline-Electric Bus

This type of machine is said to cost $1,150 less per annum for maintenance than one which is gear driven.

AFTER mature reflection, and every possible convenience for comparison, the engineer in charge of a large motor bus service in London declares that the annual cost of operating and maintaining a gasoline-electric machine carrying 36 passengers is $1,150 less than the sum which experience shows is required for the maintenance and operation of a gear driven vehicle of the straight gasoline type. As the establishment which employs this expert expects soon to own 500 of these large public service vehicles—it now has more than 300 of them in commission—it appears that a change in the transmission method would net an annual saving of $575,000 a year.

* * *

The realization of such an immense economy would have the happy effect of removing the blight which seems to have fallen upon low fare metropolitan enterprises of this character. Its establishment would exert an influence even more important than that, for such signal advantage as the electric method of transmission apparently affords is not to be reserved for the exclusive benefit of those who operate buses. All who make or use heavy duty vehicles, regardless of the service in which they may be employed, would naturally want to profit by exchanging a transmission system which gives great trouble and causes high expense for one which was known to be without either of these defects.

The advantages of electric transmission are better known abroad than here. In London the Society of Road Traction Engineers recently made it the subject of special discussion. This useful body is largely composed of the engineers in charge of operating motor bus companies. Their debates are of great public value and their conclusions of much interest to the makers of public service machines. At the last meeting of the society one of its members gave expression to the following views:

In advocating any new system of transmission it is necessary to show that it possesses tangible advantages which appeal to the shareholders and the engineers as well as to the general public. To the former, low maintenance and running costs, reasonable first costs, and freedom from police interference are the dominant factors. With the latter silence, smoothness of running, and, if possible, little or no smell from the products of combustion.

From the point of view of the public the purely electric is the ideal vehicle, and when the problem of battery maintenance at a low cost is successfully solved (there are indications that important advances in this direction are being made), it will hold the field in towns where a supply of electrical energy for charging purposes can be obtained at a cost of 2 cents per unit or less. But we are dealing with things as they exist at present, and must keep an open mind with regard to the battery question.

* * *

To a society, the members of which are experts in the running of public service and heavy commercial vehicles, it is unnecessary to dilate at any length on the difficulties at present encountered in the upkeep of a fleet of gear-driven omnibuses. The published reports of the various companies all tend to establish the fact that the heavy costs for running and maintenance are the causes of the generally unsatisfactory results, and this in spite of the efforts of the experienced engineering staff. If these items could be materially reduced the gratifying result would be a balance on the right side, and the successful future of the industry would be assured.

The problem before us is not only to produce a vehicle which will show low running and maintenance costs in the first year, but to put a vehicle on the road which at the end of five years or seven years will be as efficient and silent in its running as at the end of the first year, at a minimum cost for upkeep.

Complications of any kind must be avoided, and no technical knowledge should be required on the part of the driver. Starting and stopping many hundreds of times in a day should not injure the transmission in any way, and all undue strain on the engine should be avoided.

* * *

The equipment of factories with electrical power transmission is rapidly becoming the standard practice. If the method of transmission obtaining in factory work is an acknowledged success, why should it not be equally suitable on an omnibus chassis in which the generating plant is carried as part of the equipment? It has been contended that electric motors cannot be made sufficiently robust to stand the racket and strain of omnibus work. This, I am pleased to tell you, is not my experience. In the gasoline-electric vehicle with S. B. and S. worm drive in the service of Messrs. Thomas Tilling, Ltd., which has run 35,000 miles in public service in forty-nine weeks, the electric motors have not required repairs of any description for the last 28,000 miles, the brushes have not been renewed, and the motors are now in as good condition as when they were new. This, I think, would be an excellent record for an ordinary commercial motor driving, say, printing machinery.

As a matter of fact, a properly constructed electric motor is quite as "happy," if I may use the term, when running on a vehicle as in driving ordinary machinery, and continuous starting and stopping—the ordinary conditions of public service—do not affect it in any way.

It is true that the construction and windings of the dynamo and electric motors must vary somewhat from the standard practice employed in factory work. Special means have to be employed in the fixing of field and armature windings, and the electric motors must re-act on each other, so that the work of propelling the vehicle is divided equally between them; these important factors in the success of either gasoline-electric or electric vehicles being the result of experience in actual running under public service conditions.

* * *

So far I have dealt with the electrical equipment only. I must now briefly refer to the mechanical transmission of energy from the shafts of the electric motors to the road wheels. With the best possible electrical transmission, the vehicle as a whole must be a failure if the final (or mechanical) drive is inefficient, noisy, or will not stand up to its work. In the particular vehicle I am interested in, the final drive is on the patent S. B. and S. system, electric motors accessibly mounted on the frame driving each road wheel by means of a single reduction worm gear, a dog clutch on the worm wheel engaging with a similar clutch on the road wheel, this latter running on a floating bush on the dead axle. This form of mechanical transmission has already been brought to your notice in the paper on "The Development of Petrol-electric Systems and their Application to Heavy Road Vehicles," read before this society last March, and I am pleased to say the results anticipated therein, in the year's (or rather forty-nine weeks) running of 34,891 miles, averaging 714 per week, have been fully

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realized. It may be of interest to compare the estimated working costs given in that paper with the actual results of working for the six months ending December 31, 1908, which I am able to lay before you, together with the average costs of the remainder of the fleet—all gear-driven vehicles:

WORKING COSTS PER MILE.

	Gasoline-electric. cents.	Gear-driven. cents.
Running	1.750	3.214
Maintenance	.164	2.338
Tires	3.000	3.000
Drivers	2.490	2.490
Conductors	1.794	1.794
Gasoline	2.440	2.178
Lubricants	.134	.572
Grease	.010	.132
Paraffin	.100	.100
Vehicle lighting	.268	.272
Body upkeep	.640	.648
Traffic expenses, insurance, rent, taxes, supervision, depreciation, establishment charges, etc.	4.250	3.474
	17.040	20.212

These figures, which are official and can be confirmed, show a balance in favor of the gasoline-electric vehicle of 3.172 cents per mile; this, on an average running of 35,000 miles per annum, representing a saving of over $1,150 per annum on each vehicle. In a fleet of 500 vehicles the saving would be at least $575,000 per annum.

* * *

In comparing the figures for running costs and maintenance in the two systems you will notice a difference in favor of the gasoline-electric of 3.638 cents per mile. This great saving is due to the place of the clutch, gear box, differential, with either internal rack, chain wheels, and chains, or worm gear as the case may be, as the final drive, being taken by a dynamo, controller, and two electric motors driving single reduction worm gears, and it is on the durability of its transmission that the gasoline-electric bases its claim to existence. The dynamo, motors, and controller have run for the last 28,000 miles without any repairs or renewal of brushes, and at the end of the year's run were in as good a condition as when new, and I am confident that a year's run of 35,000 miles can be made without brush renewals. No appreciable wear has taken place on the commutators, which should last at least seven years before requiring renewal. After a run of 35,000 miles the single reduction worm drives show so little signs of wear that the life of a set of worm wheels can be set down at 100,000 miles, and the maintenance of this part of the transmission may be taken at no more than .4 cent per mile.

With several gasoline-electric vehicles in service together, it is obvious that the running costs and maintenance can be further reduced. A good armature winder and mate would be sufficient to maintain the electrical equipments of a fleet of forty to fifty vehicles in good condition.

Taking the next item in which a difference occurs—gasoline—it will be seen that the gear-driven vehicle has scored during the past six months to the extent of .262 cent per mile. The cause of this has been found, and in the future, especially in new vehicles, the figures should be on a par, with a possible advantage to the gasoline-electric.

The next items—lubricants and grease—however, reverse the position, showing an advantage to the gasoline-electric of .56 cent per mile, giving to the gasoline-electric a net advantage on gasoline, lubricants and grease of .30 cent per mile.

Having no gear box, the gasoline-electric has no use for gear box lubricant. It has the advantage also of having an engine which will run at least 300 miles to the gallon of lubricating oil.

The combined items—traffic expenses, insurance, rent, taxes, supervision, depreciation, establishment charges, etc.—count against the gasoline-electric to the amount of .776 cents, owing to the cost of the chassis of the gasoline-electric vehicle being 25 per cent more than that of the gear-driven, and also to its being subject to only a year's depreciation. As, however, the life of the gasoline-electric must be at least 25 per cent longer than that of the gear-driven, this difference may be ignored, but sufficient difference between the running costs of the two systems has, I think, been shown to induce intending purchasers to seriously consider the claims of the gasoline-electric system. It is certain that the police regulations of the future will become more and more stringent on the points of noise and smell, the first objection having been the cause of several influential public meetings in the immediate past. A gear-driven omnibus has only one period of comparative quietude—when it is new. In the gasoline-electric vehicle there is no reason why it should not run as quietly at the end of five years as it did on the first day it was put into public service.

* * *

With the advent of the electrically-propelled vehicle, whether of the gasoline-electric or the purely electric variety, the possibilities of silent running will be fully demonstrated, and it is quite possible that London may eventually follow the lead of Brighton and refuse to give licenses to gear-driven omnibuses unless on the understanding that they will be replaced as early as possible by vehicles of a silent running type.

It has been proved by experience that the public will more readily use silent omnibuses, and I contend that a company equipped with the present type of noisy gear-driven vehicles could not hold its own on the same route against a company running gasoline-electrics.

From the drivers' point of view, the gasoline-electric with its simple control, powerful brakes, and flexibility in traffic, has a great advantage over the gear-driven omnibus with its nerve racking gear changes after every stop.

* * *

To sum up, the advantages I am claiming for the gasoline-electric system as applied to public service vehicles are, from the owners' point of view—greater economy in running costs, reliability, durability, and freedom from police stops. From the users' point of view—silence and smoothness of running.

NOVEL ARRANGEMENT FOR FIRE PROTECTION.

THE authorities of Atlanta and Summerville, in Georgia, are desirous of maintaining a more efficient fire department service than is provided at present in either place. Both desire to make use of the motor driven hose and chemical wagon, but, as the treasuries are none too well filled, they have agreed to jointly purchase such a machine and use it in common. Summerville will pay the sum of $500 annually into the treasury of Augusta, in which city the motor wagon will be stationed. Augusta will pay all costs of maintenance.

LEGISLATION AFFECTING MOTOR BUSES.

EARLY last month a bill was introduced into the Pennsylvania legislature providing for the incorporation and regulation of motor bus companies in all cities within the state. The measure gives operating companies the right to carry the mails, but provides that the machines shall not be run on any street which is already occupied by a fixed rail line for more than 20 per cent of its length. The capital stock of any motor bus company, under a provision of this bill, is not to be less than $25,000. The bill has been referred to the house committee on municipal corporations.

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WHERE HORSES FAIL.

SHORT but sharp grades test the capacity of draft animals very severely. It is common to witness the unfortunate brutes vainly attempting to haul heavy loads up the insignificant looking inclines which in large cities frequently connect alleys with streets. In the course of a year many hours of valuable time are lost in ineffectual work of this sort. In winter, especially in streets which are so narrow that the teams cannot be so maneuvered as to get headway, such spectacles may often be observed.

But there are plenty of other occasions when the inefficiency of the horse is demonstrated. One may stand at any of the ferries in New York and learn a lot about it. Incidentally he may observe how the motor wagon behaves under circumstances which are calculated to cripple horse transportation service.

One morning not very long ago a Cortland street ferryboat had been docked. It was loaded with passengers and horse drawn vehicles, and had a big five ton motor truck aboard. The motor truck was first off the boat, and, as the tide was somewhat low, it had a climb to make in order to reach the street. Notwithstanding its big load the truck shot up the incline and out into the street, and then the poor horses tackled the grade with their loads. It took several minutes for one of them to get up after the wheels had been blocked several times.

It is unofficially stated that the American Express Company is building motor wagons in Auburn, Ind.

NEW YORK'S NEW FIRE WAGON.

EVERY official in the New York fire department service is well satisfied with the work of the seven ton motor hose and chemical wagon which was installed by the Knox Automobile Company the middle of last January. The machine is driven by a 50 hp., 4 cylinder engine. It has a rated speed capacity of 30 miles an hour. The wheel base is 154 inches. The radiator is built flush with the dash. Back of the driver's seat the standard for the fixed nozzle is mounted, to which the high pressure hose is attached. The crew of the machine consists of 10 men. It is equipped with 2,000 feet of 3-inch hose. In service the machine usually rounds corners at about 12 miles an hour. It is shaft driven.

MACHINES IN OHIO MUST BE REGISTERED.

COMMERCIAL motor vehicles of every kind in the state of Ohio must be registered hereafter. The legislature has just passed an amendment to the state automobile law providing for registration and license, the license fee being fixed at $5 per annum. It is estimated that there are about 2,000 commercial motor vehicles in the state. In order to prevent dodging of the license fee the state authorities have decided to change the color of the registration tags each year.

The International Motor Truck Company, of Wilmington, Del., has been incorporated with capital of $500,000.

Knox machine used in the New York fire department service.

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MOTOR TRUCK SERVICE NEEDED.

THE following letter is highly suggestive of the larger uses yet reserved for the motor truck:

"To the Editor: Your interesting and edifying publication presents to us the long desired avenue through which we can hope to gain the necessary information touching the availability and practicability of uniting this city with tidewater in San Pedro Bay, our harbor, distant 18 to 20 miles. This is an ideal situation, there being practically no grades to contend with, and I write you for further information.

"I would like the location of any or all truck lines handling light or heavy goods, and the distance traveled. Certainly this is a great field for the automobile truck.

"Our county will expend, within the next two years, $3,500,000 to build a permanent system of highways throughout the county. Of course, you will understand that we will, in establishing these truck lines, meet with strenuous opposition from the railroads, but every forward movement has its obstructions.

THE HARBOR COMMISSION.
Los Angeles, Cal. A. P. Fleming, Secy.

Page—" 'Ere, what's the good o' you turning up? I whistled once."

Cabby—"Well, I thought as——"

Page—"One is for a taxi, ain't it?"

Cabby—"Yus."

Page—"An' twice is for a 'ansom?"

Cabby—"Yus."

Page—"Well, when we wants you we'll send yer a post-card!"—Tit-Bits.

A motor hose and chemical wagon will be bought for use in Franklin, Pa.

THE WASHINGTON CAB DRIVERS' STRIKE

SOON after the drivers of the Terminal Taxicab Company of Washington, D. C., went on strike their places were filled by others apparently just as competent. The drivers who are out of employment assert that the pay offered the new men is not that offered before the strike went into effect. It is alleged by the strikers that the men who fill their places are receiving $2.50 a day. They say that this rate is paid to break the strike and force the former drivers to return to work, when they will be compelled to take what is offered them. The company employs 38 machines.

The strikers further state that the acceptance of the proposed wage scale would reduce their earnings one-half. They have been earning from $70 to $75 per month and using from ten to twelve gallons of gasoline a day. If they are compelled to buy fuel from the company at 10 cents per gallon, or more if the market goes up, they claim that their wages will be reduced just that amount. As the new scale provides for a lower wage than they have been making they claim they could not possibly earn more than $37 per month.

The manager of the company says: "We are very liberal with our drivers. In the matter of gasoline we charge but one-half cent more than the cost per gallon to us at wholesale. This means selling at a loss. Other companies charge the men regular retail price. We charge them nothing for burnishing their cars. Other companies make their men pay for work of this character."

The purchase of motor driven fire vehicles is unofficially approved by the mayor of Knoxville, Tenn.

A contract has been let for the collection of mail by automobile in Pasadena, Calif.

This picture shows the nature of the service in which the New York Dock Company's electric trucks are employed. The machines were described in the March issue of this journal.

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TO SUBSIDIZE MOTOR WAGONS.

AT the opening of the French parliament the minister of war will ask for the appropriation of $375,000 to be spent for the subvention of privately owned motor vehicles which are capable of rendering effective transport service in time of national danger. The German war authorities have already obtained the passage of a similar measure. The French plan provides for an indemnity of $600 a year for each vehicle requisitioned for a period of three years. Only wagons, tractors and road trains will be entitled to the subvention.

Maximum weight limits, including full equipment, are three tons for a four wheel vehicle and 4½ tons for one with six wheels. For these machines the useful load must not be less than two tons. Any type of tire may be used. The front wheel diameters must be 33 inches and the driving wheel diameters 37 inches. The engines with which the wagons are equipped must be capable of operating with gasoline, alcohol or benzol, and enough of any one of these fuels must be carried for a journey of 125 miles. The average speed must not be less than 7½ miles per hour over a 62 miles course. All wagons must be geared so as to permit the easy ascent of a 15 per cent grade.

Motor trucks pulling trailers will not be permitted a greater weight per axle, under load, than four tons. The useful load of trailers is fixed at seven tons for a grade of one-tenth and five tons for a grade of one-eighth. Trailers are to be equipped with metal tires. A road speed of not less than five miles an hour must be maintained over a distance of 50 miles with a motor wagon having a seven ton load in tow on grades of one-tenth.

The maximum weight per axle for road trains, under load, is fixed at four tons, the useful load being put at eight tons minimum. The speed of these trains is fixed at 5½ miles per hour over a 50 mile course. Each unit of the train must be equipped with individual brakes.

There are now nine passenger automobiles in service between the mining camps at Springdale and Pioneer, Nevada.

It is likely that Armstead and Grant, Mont., will be connected by motor bus this summer.

Crated vegetables and fruits are now being regularly transported by motor wagon along the San Fernando road to the San Francisco market.

MUNICIPALITY TO CONTROL CAB RATES.

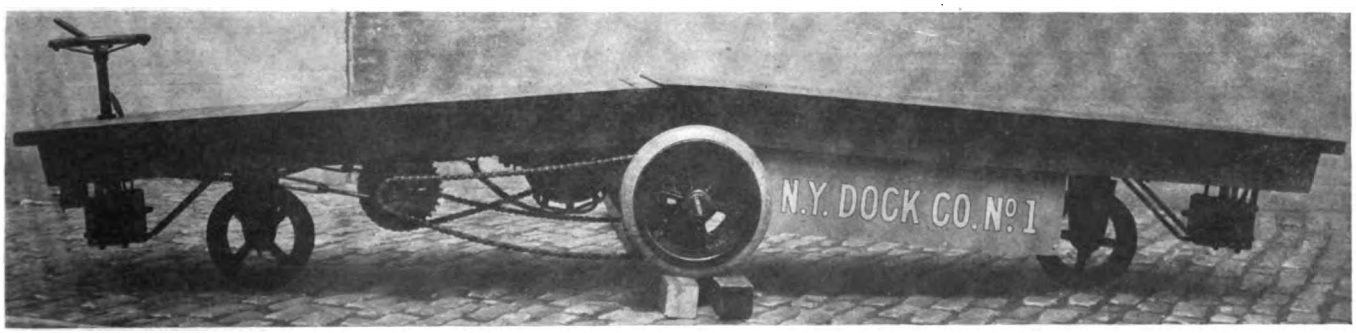
AN ORDINANCE is about to be submitted to the Chicago board of aldermen providing for municipal control of motor cab service. Uniform rates and periodical inspection of taximeters will follow the passage of the measure.

At present each of the four operating companies has a tariff of its own, the divisions and subdivisions of which are puzzling in the extreme. A close friend of the mayor's recently tested the accuracy of the system under which charges are made by riding from his residence to his office for the period of a week. Upon each occasion he traveled exactly the same route. It was found that the fare varied all the way from 10 to 75 cents. Three of these trips were made in the same machine.

Two of the operating companies charge 30 cents for the first half mile, while the other two charge 50 cents for the same distance for one or two passengers. All four companies have different charges for railway depot and theater service. The charge for children and baggage also varies. About the only uniform charge is that for waiting time, which is 10 cents for every six minutes. Some clubs, hotels and cafes get a discount of 20 per cent, retaining 10 per cent of the commission.

The proposed ordinance provides for official examination of taximeters at least every six months by the city sealer. Anyone who doubts the accuracy of a recording instrument may deposit 50 cents and compel the city authorities to make an examination of it. If inaccuracy of the mechanism is proved the complainant will be refunded and the cab owner will be prosecuted. Fines ranging from $10 to $100 are provided for charging a higher tariff than is to be declared legal, or for lifting the flag which cleans the face of the taximeter and causes the registering marks to vanish before the passenger can check the accuracy of the fare demanded. For the protection of the cab proprietor a penalty is provided for running a machine containing passengers with the flag up.

The ordinance also provides that the taximeter shall be connected to the front wheel of the machine. The fare for two passengers is fixed at 50 cents for the first mile and 10 cents for each additional quarter of a mile. The fare for three or four passengers is 70 cents for the first mile and 10 cents for each additional quarter of a mile. The time rate is $4 for the first hour and $3 for each succeeding hour for two passengers, and $5 for the first hour and $4 for each succeeding hour for more than two passenges.



New York Dock Company's electric truck, showing hinged platform for the relief of load at the center when side wheels are mounting a road obstruction.

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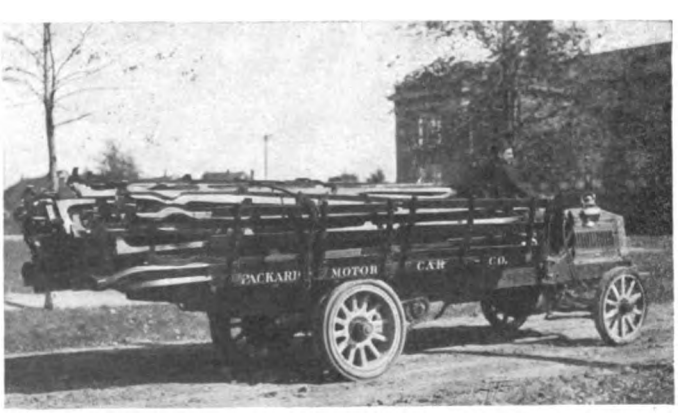
LIFE AND WORK OF A MOTOR WAGON.

THE algebraic symbol for the unknown might very fittingly represent the life of a motor wagon, for it is anything that may be demonstrated. In competent hands the machine will last a long while, much longer indeed than the majority of users imagine. Its mileage and tonnage records, under the most favorable conditions of management and operation, often amaze even those who are well accustomed to observing its brilliant work performances. But badly administered, and neglected till it fairly shrieks for attention, it soon deteriorates, leaving a record of service which it is painful to contemplate.

Examples of long and satisfactory service are far more common than it is the habit to suspect. There are slow moving, heavy duty steam machines which have been in commission constantly for eight years. Barring the obsoleteness of their design, they are still in first class condition. There are gasoline machines which have done the work of twenty horses in the last four years, earned their cost twice over, and yet continue to hold the road without much perceptible depreciation of value. There are electric wagons and trucks which have not been out of action for more than a few weeks in the course of seven years' work, and these, too, are in sound condition of repair and good for another long stretch of service. But these splendid records are only available as a result of the intelligent care and attention which has been bestowed upon the machines. They have not been permitted to lose efficiency in proportion as they have aged. Such mechanical deterioration as would naturally occur has always been anticipated and remedied before there was any chance of its being communicated to parts not affected by service. Practice of this sort is part of science of maintenance.

The Packard company uses its own three ton trucks in hauling merchandise and supplies between the factory and the freight depots. One of these machines was commissioned in 1907. It has now a record of 522 days' service. It has traveled 16,489 miles and made 1,373 trips, and it has hauled almost 4,000 tons. The daily load has been 15,006 pounds, the average trip load being estimated at 5,705 pounds. The gasoline consumed has amounted to 3,548 gallons, or an average of 4.64 miles per gallon. The truck is now being repainted and overhauled. When it emerges from the shop it will again be put into service.



Packard wagon which in 522 days covered 16,489 miles and hauled 7,833,022 pounds of freight.

The Packard factory being about four miles from the business center of Detroit, the company employs a special delivery car for carrying the mail back and forth, and for other work requiring prompt service. This car went into commission on March 10, 1906. As an experimental machine executives of the company and members of the engineering department drove it 55,000 miles. Last April it was equipped as a delivery wagon and in that capacity has done active work for 252 days, covering 17,742 miles, making 1,509 trips, an average per day of 70.4 miles. Thus, between its road service and its later work as a light delivery wagon, this machine has made about 73,000 miles.

ECONOMY OF MUNICIPAL MACHINES.

SINCE it was announced that the Paris authorities had decided to get rid of the horse drawn vehicles with which its fire department is equipped much public curiosity has been exhibited to know the extent of the economy which the motor vehicles, which are to take their place, are expected to afford. At the present time there are 76 horse drawn fire department vehicles in service. Their maintenance costs about $64,000 a year. It is estimated that the cost of maintaining the same number of motor driven vehicles would not exceed $17,400. As has already been announced in this journal, there will practically be no horses employed in the Paris fire service by the end of 1914.

HORSESHOERS FIND WORK SCARCE.

BEFORE the motor car, bus, cab and wagon acquired vogue horse-shoeing was a lucrative occupation. But nowadays the farrier is a very melancholy and idle person. His trade decreases and its extinction is threatened. In Detroit the business is in a very bad way. At the last meeting of the local Federation of Labor the delegate from the horseshoers' union made this pathetic confession:

"Work is scarcer, horses are fewer, our trade's shot to pieces, and shops are being deserted every month. There will soon be nothing for us to do but go to work in a motor vehicle factory."

Motor trucking charges for ordinary merchandise in Tokio, Japan, are as follows: $2.50 for one mile; $11 for five miles. Higher charges are made for transporting valuable merchandise. Rainy weather service commands more money than fair weather service. A machine, driver and porter may be hired for an eleven hour day at $12. Half a day's work with such an outfit costs $6.50.

There are about 1,800 motor cabs in Germany at the present moment, distributed as follows: Berlin, 1,500; Frankfort, 31; Nuremburg, 40; Munich, 134; Leipsic, 24; Hamburg, 39; Hanover, 20; Dresden, 20; Magdeburg, 15; Cologne, 31; Breslau, 24.

Motor ambulance service is now being furnished by the Flower hospital in New York City.

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Underground Freighting in Chicago

Neither its volume nor its character affects surface transportation of merchandise by motor wagon.

OUTSIDE of Chicago an impression prevails that the underground freighting operations of the Illinois Tunnel Company are likely to assume proportions of such magnitude as to make surface transportation seem trivial in comparison. Even within the city itself there are many who entertain the same ridiculous idea. It is always easy to create an exaggerated opinion of the importance of an enterprise which is not openly conducted.

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Investigation of the conditions attending underground freighting in Chicago does not tend to confirm the vague expectations which are held concerning the development of this mode of transportation. It is true that a very considerable number of large commercial establishments within the congested business district avail themselves of the convenience of tunnel electric trucking, but it also appears that the volume of business which is offered by these concerns practically exhausts the capacity of the equipment. Without widening the tunnel and providing more tracks and trucks it is absolutely impossible to expand operations. To be sure there are certain hours of the day when more tonnage could be hauled, but the inconvenience of accommodating shipping to carrying conditions is not easily overcome. While the tunnel company had the benefit of carrying the government mails it was possible to utilize a good many hours of the night in transferring freight of that character. Commercial houses, however, cannot be expected to keep their operatives on duty all the time for the convenience of carrying companies.

Hence it is discovered that the monthly revenue of the tunnel company is comparatively small. Its 1,500 trucks of 2-ton capacity are not by any means actively employed. The minimum rate is 40 cents per ton. On this basis the company is now earning about $36,000 a month, which is barely enough to defray the cost of operation and maintenance and leave a small balance available for interest payments. The shrinkage in the company's earnings since the cancellation of its mail carrying contract has been very heavy. It will be recalled by readers of this paper that the company was willing to renew that contract upon a basis of $300,000 per annum, which sum represented an advance of about 20 per cent of the previous contract price.

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It is extremely doubtful, considering the mystery which has surrounded the Illinois Tunnel Company ever since its flotation, if the municipality would consent to any enlargement of its powers. It is quite certain that in this day of partnership relations between semi-public corporations and municipalities that no further privileges would be granted without the express stipulation that the city was to share in the profits of the enterprise. The city of Chicago gets 55 per cent of the earnings of its street car services, which are also public utilities. Assuming that the same percentage was exacted from the underground freighting company in consideration of a grant authorizing the expansion of its operations, it is impossible to think that the present carrying rate would be continued. The alternative in such a situation would be to raise the rate in order to provide an increase in revenue and take care of the heavy bonded indebtedness of the undertaking. Under such circumstance it is extremely improbable that, despite the convenience of being able to load and receive carload merchandise within the precincts of a warehouse, many establishments would be willing to pay the greater cost of such service. There is a limit to the willingness of business houses to be taxed for improved methods of administration.

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The truth of the matter is the Illinois Tunnel Company is a white elephant on the hands of its owners. The volume of its business does not and cannot advance under present conditions. The chief reason for this state of affairs, aside from the loss of the mail carrying contract, is the disinclination of business houses to furnish the required loading and unloading facilities and the sanguine expectations which are held concerning the development in surface traffic as a result of the employment of the motor wagon. The majority of Chicagoans look with suspicion upon the tunnel enterprise, the franchise for which was obtained from aldermen who little suspected the actual nature of the business which was to be transacted by the beneficiary. It was generally supposed at the time of the passage of the ordinance authorizing the construction of the tunnel that the bore was designed for the accommodation of telephone and telegraph wires. If there ever was any intention of using it for such a purpose the evidence of that object has not yet materialized. It was further stipulated in the franchise that the company was to operate an extensive telephone system, being pledged under penalty to install about 30,000 machines. This pledge is yet to be redeemed, although the period for its fulfillment has been twice extended. Looked at in the large the whole enterprise has a queer appearance. It is commonly understood that the property, franchise and all, is owned by Harriman in the person of a few very influential Chicago capitalists. This much, however, is certain—its shares of stock, nominally worth $100, are quoted on the market at about $27. Its earning capacity is a negligible quantity, while its traffic operations are neither being pushed with vigor nor encouraged with cordiality.

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Underground freighting does not visibly affect surface transportation, although it is reasonable to suppose that if 1,200 two-ton trucks are operated with anything approaching activity the street traffic must be relieved to some extent. But it must be borne in mind that the traffic of the streets increases at such a rate that the service of many small bore underground freight systems would be insufficient for the permanent relief of the congestion

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which prevails and grows. It would be wiser to hope that eventually street traffic congestion will be alleviated by the employment of the motor wagon, which reduces the number of vehicles now in use and economizes in the room occupied. The underground freight tunnel can hardly be considered as competing with the service of the motor wagon. The former provides a class of transportation in which the road machine is seen at a great disadvantage, namely, the hauling of incoming and outgoing bulk freight between warehouses and railway freight depots. Tunnel service is not adapted to the needs of small shippers. It has no value at all for establishments which must receive or distribute merchandise outside of the comparatively small district which is known as the heart of the city. It is essentially short haul service, and on this account is not in interference with motor wagon transportation which, to be at its best, requires considerable length of haul.

Indeed much might be said in commendation of underground freighting without in the least disparaging the cause of motor wagon transportation. Railway freight depots are very properly regarded as places where much time is idly consumed by machines which are kept waiting in long lines of vehicles which await the chance of getting near the loading platforms. It is necessity rather than choice which requires motor wagon operators to keep their vehicles in service of this sort.

* * *

No fear need be entertained that underground freighting will, within the life of the present generation, very materially improve surface traffic conditions, or will in the least degree retard the development of motor wagon haulage. The experiment in Chicago has its well-defined limitations. It is practically a political and physical impossibility to expand them.

HAULING EXTRAORDINARILY LARGE LOADS.

WHENEVER the roadway is firm enough for hauling extraordinarily heavy loads by motor truck the machine, generally employed in such cases as a tractor, exhibits a capacity and economy far beyond that of draft animals. Horses are so severely taxed in service of this class that their owners deem it prudent to exact a very high price for the work.

Upon a recent occasion a New York brewery found it necessary to transport two 25-ton engine castings for the distance of a mile. It was decided to haul one of them with two five-ton four-wheel drive electric vehicles made by the Couple Gear Freight Wheel Company, the load being independently mounted on a high wheeled truck. The other casting was hauled by horses. The machines were coupled in tandem fashion. Their load reached destination 48 minutes after it had been got under way. Six helpers and two drivers made up the crew of the motor transport outfit. The horse outfit required a whole day for the passage of its load, a capstan and tackle and a small army of men and animals being employed.

Four steam-driven cabs have been placed in service in Albany, N. Y.

MOTOR TRUCK PLANT AT ANN ARBOR.

GASOLINE motor trucks will be manufactured in Ann Arbor, Mich., by the Triple Motor Truck Company, which is being organized by Fred O. Paige and H. A. Wilcox, who, until stock control in the Reliance Motor Truck Company was obtained by Mr. Durant were respectively president and chief engineer of that concern. The capital of the new company is $340,000. It is understood that a building measuring 600 by 65 feet will soon be erected. The sum of $225,000 is being raised among the business men of Ann Arbor.

TO MAKE MOTOR WAGONS.

THE York Carriage Company, of York Pa., has let the contract for the construction of a building in which it will manufacture commercial motor vehicles. The building will be ready for occupany early in the summer. The design of models to be made has been decided upon, but the company does not wish to make any announcement on that subject at the present moment.

MAY BUILD WAGONS IN ST. PAUL.

EFFORTS are being made to induce the Four Traction Auto Company now located at Mankato, Minn., to consent to the removal of its plant to St. Paul. At present the concern is capitalized at $250,000.

DOWAGIAC COMPANY BUYS A PLANT.

THE factory of the J. V. Lindsley Company, located at Dowagiac, Mich., has been purchased by the Dowagiac Motor Car Company. The new owners will make commercial motor vehicles of various ratings and for various purposes.

TO MAKE MACHINES IN LOUISVILLE.

ANNOUNCEMENT is made of the formation of the Weber Auto Truck Manufacturing Company in Louisville, Ky. The capital stock of the concern is $10,000.

SOUTHERNERS TO MAKE MOTOR TRUCKS.

GASOLINE and electric machines will be made by the Weber Auto-Truck Manufacturing Company, of Louisville, Ky., an organization which has just been chartered to do business with capital stock of $10,000.

Preparations are being made to operate a motor bus line between the railroad terminal in the San Antonio canyon, California, and the neighboring camps.

Denton and Sanger, in Texas, are to be connected by motor bus.

The Texas Transfer and Taxicab Company has been organized at Houston, with capital stock of $20,000.

Eight motor freight road trains have been subsidized by the Bavarian war office for the ensuing year.

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MILLIONS FOR MOTOR CAB INVESTMENT.

MONTREAL, Toronto, Ottawa and Winnipeg are Canadian cities selected for the operation of motor cabs by a company which is being formed with capitalization of $2,000,000. It is stated that the machines will cost between $1,250 and $1,300 apiece. In order to obtain the maximum space for passengers and their baggage the operator's seat will be placed back and above the body of the vehicle, as in the case of horse drawn hansom cabs. Curiously enough, an ordinance in the city of Montreal prohibits the operation of motor cabs for hire. The organizers of the company, however, are working for the removal of this formidable barrier.

WHEEL TAX AGAIN DECLARED LEGAL.

ONCE more the supreme court of the state of Illinois has pronounced upon the legality of the ordinance under which the owners of all classes of vehicles using the streets of Chicago are taxed. The constitutionality of the measure is again upheld. This third attempt to escape taxation was undertaken at the instance of a prominent automobile club and the local automobile trade association. Discrimination and interference with the state motor vehicle statute were the weapons of attack. If there is to be any further legal protest against the tax it will be necessary to carry the quarrel to the United States supreme court.

Following European practice, some American motor cabs are now being fitted with a top the only part of which folds is that at the rear of the standing pillar back of the door. This construction eliminates one of the openings in the top and minimizes the possibility of rain leakage. Instead of folding joints in the top rail there is now a rigid and stable structure.

The property loss from fire in the United States last year amounted to $258,000,000. Much of this immense waste would have been avoided if even a small percentage of the fire department vehicles were motor driven. Then, too, there is the needless sacrifice of human life to be considered.

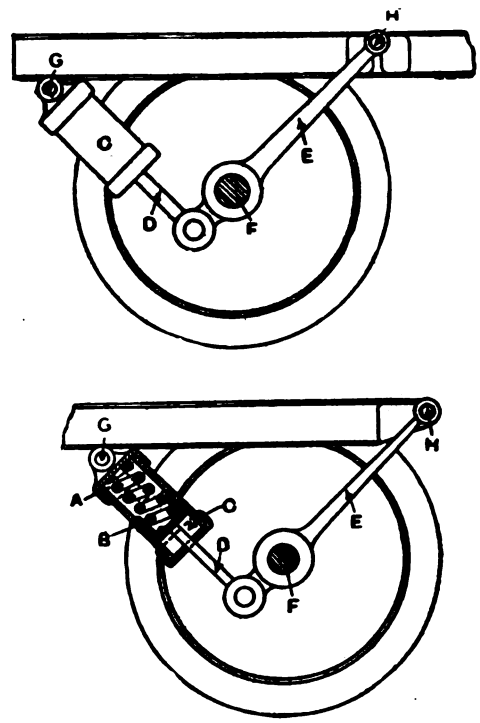
Flight through the air may very likely become as popular a fad a few years hence as automobile racing is today; but it will have just as little relation to the serious, practical, everyday business of carrying freight and passengers for the great workaday world as have the 100-h.p. automobiles that break speed records.—Engineering News.

Twin and triple pneumatic tires were only made possible by the advent of the demountable rim.

The makers of a British one-ton gasoline wagon estimate that the total cost of normal haulage by their machine, all charges included, is 13 cents a mile. Depreciation is computed at 15 per cent, repair cost for 15,000 miles per annum at $250, and tire expense at 3½ cents a mile.

NOVEL SPRING SUSPENSION.

HELICAL springs are often found complementing the work of laminated springs, but in the form of suspension shown in the accompanying drawings they are the sole means for cushioning load. The rebound is taken care of by the action of a piston which bears upon the helical spring and is enclosed in a cylindrical casing. The device is closely related in design to that which was printed in this paper some time ago.



The cylinder, together with the piston rod, forms a radius member between the chassis and the axle. But instead of being connected directly to the latter, it is pinned to an extension below it and formed integral with a second radius member also attached to the frame and to the axle. The two members of the suspension group thus form a triangle, the altitude of which varies as the body oscillates over the axle. The cylinder, C, which contains the spring, is articulated to the frame at the point G, about which it is permitted to oscillate, while the piston rod D is linked to the lower end of the radius member E, which in turn is pivoted to the frame at the point H and to the axle at F. A triangle is thus formed with G-H as its base, and its apex at the point of connection between the link E and the piston rod D.

Obviously as the frame rises and falls, the effect of the motion will be to alter the altitude of the triangle, the necessary lengthening or shortening of one of its members being accommodated by the movement of the piston in its cylinder, and against the pressure of the contained spring. The second of the two illustrations shows the device in section, and reveals the position of the spring and piston within the cylinder. By properly designing the cylinder and piston the effect of a piston shock absorber may be secured, without in the least interfering with the action of the spring; while at the same time the latter is protected from the effects of dust and dirt as well as rust.

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Inaccurate Taximeters

Municipal inspection of recording instruments on public service motor vehicles is demanded in New York.

THE vagaries of taximeters in New York City have been so persistent of late as to become the subject of official investigation. One of the aldermen, following the lead taken by the Washington, D. C., authorities, expects to introduce an ordinance providing for municipal inspection of the instruments. It is his purpose to have the city stamp or otherwise designate the registering devices which have been tested and found accurate.

Officials of the large cab companies indorse the proposed action. The head of one of them thus comments upon it:

"We are heartily in favor of official supervision of the taxicab meters by the city. Things have come to such a pass through the fraudulent methods employed by some of the smaller concerns that unless something is done the taxicab will fall into the same disrepute as the horse cab.

"Anything that will give the public confidence in the accuracy of the meters and the fairness of the charges will be the best thing for business that is legitimate and the worst thing for the companies trying to get the most out of the public. The business has grown to such an extent that it is time to become subject to regulation here as it is to foreign cities. There are more than 800 taxicabs in New York and before the year is over there will be 2,000.

* * *

"The unscrupulous driver can profit by the ignorance or inattention of the passenger. One passenger having been discharged, and another immediately hailing the cab, the driver may not throw the flag from the 'non-recording' position to the 'vacant' and then to the 'tariff' position, as he should, but on some makes of taximeters can move it from 'non-recording' backward to 'tariff.' If the passenger does not notice this, at the end of his trip he will be required to pay the sum shown on the taximeter, which includes the charge of the previous passenger as well as his own.

"This is particularly likely to be the case where the first passenger had only a short ride, the driver being reasonably certain that the second passenger will not quibble over a matter of 30 to 60 cents. Again, with any make, at the end of the trip the driver may move the flag from the 'tariff' position through the 'non-recording' to the 'vacant' without stopping. The figures will thus disappear from the face of the instrument before the passenger has had time to read them, and must take the driver's word as to the change.

* * *

"The taximeter is actuated by means of a flexible cable driven by a star wheel that is operated by the rotation of one of the vehicle wheels. The connection between the star wheel and the vehicle wheel may be by spur gears, or by a spiral of 1⅛ turns attached to the spokes of the driving wheel. With taximeters operating by a spiral, it is possible in some cases to bend this in such a manner that it engages two teeth of the star wheel where it should engage but one, the taximeter then ryegistering double.

"An accurate operation of the taximeter cannot be secured when it is driven by one of the driving wheels of the car. The driving wheels are controlled by the engine, and if running on a slippery pavement they may revolve more than once, where the front wheels, which are actuated by the forward movement of the car, would make but one revolution. If a driver runs his car with the taximeter controlling wheel on a slippery portion of the pavement while the other driving wheel has good traction, a far greater mileage will be recorded by the instrument than should justly be the case.

* * *

"In certain European cities it is against the law to operate taximeters by one of the driving wheels of the vehicle, and this is undoubtedly a great protection to the traveling public.

"The taximeter is protected by lead seals, which must be broken in order that access may be gained to any part of the mechanism. Because of this, the driver does not attempt to dismount any of the mechanism; and even should he dismount the star wheel, so that the instrument will not register at all, the discrepancy between the normal mileage of his car and the reduced mileage shown by the instrument as a result of his act, would lead to his prompt detection.

"In London all taximeters are under the strict supervision of the police department, and not only must each make be passed upon, but every instrument must be tested and stamped before it can be put into service.

"In Paris, as well as in London, the police have the authority to stop any taxicab for the purpose of inspecting the instrument and receiving assurance of its correct operation, and can also arrest any driver whose flag is not in the proper position for the number of passengers he is carrying.

* * *

"The large companies operating taxicabs in New York City are sincere in their endeavors to protect their patrons from overcharges, and inquire into all complaints. A considerable proportion of the complaints made to them are due to the carelessness of the passenger in not noticing the position of the flag or in neglecting to read the instrument, and in unfamiliarity with its operation.

"In going to a point exactly one mile distant from the starting point, for example, the direct run would record a charge of 50 cents; but if traffic conditions required the driver to go even slightly out of the way, the instrument would record 60 cents. The taximeter measures the distance in units of one-quarter of a mile, and makes its charge in advance. A recognition of this fact would remove one cause of discussion between passenger and driver."

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PNEUMATIC-TIRED NEWSPAPER WAGONS.

THE daily newspaper publisher's conception of a motor delivery wagon is a machine which is capable of carrying very considerable loads at high speed. The distribution of this class of merchandise has become so competitive in character as to prevent proprietors from considering the machine ordinarily used in business as at all suitable for their purposes. Under such circumstances it is not surprising to learn that up to date manufacturers have not succeeded in selling much of their product to investors of this type. They prefer cultivating the acquaintance of firms which have no exaggerated conception of the duties of a commercial motor vehicle, leaving the custom of the publishers to those who care to manufacture special designs.

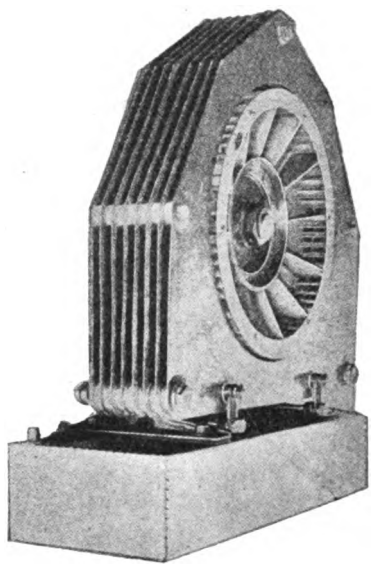
Some time ago the Paris branch of the New York Herald bought a few machines of French manufacture and found that their employment very materially improved the delivery service. Encouraged by the results of this experiment it was decided to equip the New York office with five machines of like character, and on March 21 they were commissioned for service. The New York machines are peculiar inasmuch as their rear wheels are fitted with twin pneumatic tires. Three of them are rated to carry 3,400 pounds and two to carry 1,800 pounds. The lighter machines are equipped with engines developing 10-14 hp. Their wheel base measures 118 inches. They are provided with three forward speeds, and weigh 2,200 pounds apiece. The heavier machines are equipped with engines developing 14-20 hp. They have a wheel base of 144 inches and four forward speeds. They weigh 3,400 pounds apiece. The machines of both ratings are shaft driven and fitted with high tension magneto ignition. They are of the Renault type. The heavy machine has a four cylinder engine and the light one a two cylinder engine.

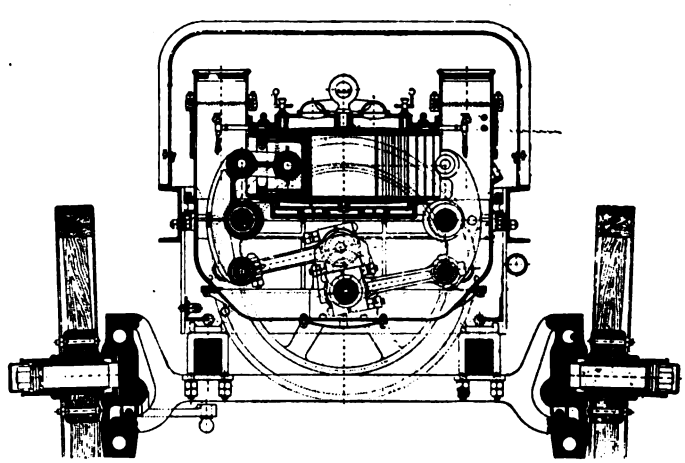
Although the publisher of the Herald thus indicates his preference for foreign machines he does not entirely despair of the ability of American manufacturers to keep him supplied with slow speed motor trucks, of which there are several now in his employ.

Almost any high class American touring car, with reinforced construction and the special wheel equipment which has been provided for the Herald distributing wagons, would be capable of giving as economical service as the machines in which Mr. Bennett has just invested. But he has evidently fallen under the spell of European engineering. He has paid twice as much for the wagons as they are worth; still he has a novelty, and that after all is the priceless possession of a journalistic establishment which can afford it. If Mr. Bennett had not contributed half of his investment to our customs officers his distributing equipment would be doubled. Time will tell if these imported machines are twice as economical as similar vehicles of native production. There is not a manufacturer in this country who would not be willing to bet his factory that if the records are produced it will be shown that Mr. Bennett has made an exceedingly bad investment, however much it may gratify his pride or his personal preference.

PECULIARITIES OF THE SOLLER MACHINE.

ANOTHER view of the single cylinder engine of the Soller wagon, to which reference was made in last issue of this paper, is herewith presented. It is accompanied by a picture of the cooling device. The machine, by the way, is made in Switzerland. The engine is placed horizontally. Each cylinder bore is 7 4/5 inches; each piston stroke is 5 7/10 inches. A low tension magneto provides ignition. The radiator is placed behind the





engine, which drives through a large metal to metal clutch, sliding change speed gear, a differential countershaft and side chains. A horizontal shaft in the front of the engine carries the cam operating mechanism and the gears for driving the pump and lubricator, which can be inspected by removing a plate. The change speed gear provides six forward speeds. Reverse speeds can be obtained on any of the gears by sliding a right and left crown bevel on the countershaft into mesh. The novel design of the cooler is apparent from the illustration. It consists of a series of metal sheets brazed in pairs at their edges, eight pairs of these sheets surrounding the fly wheel fan.

An electric 5-ton truck is operating in Vancouver, B. C., at a cost for power of approximately 80 cents a day. The machine is capable of hauling 100 tons daily.

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OVERHANGING TREES BAR BUS TRAFFIC.

THE low hanging limbs of some of the trees along the Riverside drive in New York have caused the park authorities to issue an order that no vehicle over ten feet in height shall be allowed on that fashionable thoroughfare. This decision vitally affects the interests of the Fifth Avenue Coach Company, which operates motor buses on Fifth avenue and 72nd street, and was just preparing to extend its service along the Riverside drive to 135th street. Anticipating the unhampered extension of its service, the company recently placed an order for 25 additional machines, involving an outlay of $125,000. An official of the company thus comments upon the situation which has arisen:

"Our motor buses, which have been in use for years, are twelve feet high, the same as the old horse drawn vehicles, and the new ones we have ordered are of similar height. They carry sixteen passengers inside and eighteen on the roof. To lower the present height of our buses would not only cut our revenue in half, but would reduce our service over 50 per cent. At the present time we are the only public service corporation in the city that provides a seat for every passenger at all hours of the day and night. There is no real danger to the trees (or to passengers, either, which is more important), as our buses are lower than similar vehicles in use on the avenues and boulevards of London, Paris and other European cities, where conditions exist exactly similar to those on Riverside drive. In one or two sections along our route there are a few trees whose branches extend over the roadway in such a manner that they might brush against the passengers on the upper seats; but all that is necessary would be to trim or prune the trees, as is customary every fall, which would in no way mar the appearance of the trees.

"Instead of doing this the park department wants to stop the operation of our buses and prevent thousands of New Yorkers and out-of-town visitors from enjoying, at a moderate cost, a trip over the finest drive in the city and a view of the beautiful Hudson river and the Palisades. With our new service we expect to carry from 7,000 to 10,000 passengers daily, and it would work not only a hardship on us, but on the public as well, to deprive them of the privilege of using the Riverside drive. Not only this, but the sight-seeing buses—many of which are quite as high as our buses—have used Central park and Riverside drive for years without any interference and have never caused any damage to the trees."

The automobile club of France has just appointed a commission to encourage the application of the agricultural motor. For the next four years practical tests and exhibitions will be given in order to diffuse knowledge concerning the usefulness of this type of machine. A plot of ground for experimental work has been purchased.

A company has been formed with capital stock of $25,000 to furnish motor bus service between Tottenville and New Dorp, N. J.

NEW YORK CAB PROPRIETORS RAISE RATES.

SOME of the largest motor cab operating companies in New York City have come to the conclusion that a rate of 30 cents for the first half mile is not enough to pay dividends upon investment, and accordingly have raised the tariff by 60 per cent, the present tariff being 50 cents for the first half mile and 70 cents for the first mile. Former rates were 30 cents for the first half mile and 60 cents for the first mile. It is stated that this bold move is merely preparatory to combining the concerns which are party to it.

The decision to increase the fare was reached about six weeks ago at a meeting called by the president of the Taxi-Service Company, which organization was recently incorporated with capital stock of $2,200,000 for the purpose of taking over the motor cab business of the Waldorf hotel and other service of like nature. W. H. Scaich, who for years has had a monopoly of cab service at the Waldorf and other large hotels, makes the following interesting announcement:

"I believe a merger of all the big companies will take place within a year. Even under the increased rate established last month, the companies are finding that every cab costs them $12 a day, and the earnings of each cab are less than $15 a day. What makes each taxicab cost the company so much is what we call the 'dead mileage'—the coming back to the stand three miles every time the taxicab has carried a passenger three miles. The gasoline, wear and tear, and chauffeurs' wages are just the same whether the taxicab carries passengers or is empty.

"The only way to do away with this dead mileage is to establish a great number of taxicab stands under a single management all over the city. After dropping his fare, the chauffeur would go to the nearest stand and wait until he was chartered by another fare. The organization of such an elaborate system of taxicab stands could hardly take place while the companies were competing with each other. When a merger is formed, also, the rates can with profit go down to the old sixty-thirty basis."

During the recent strike of street car drivers in Pittsburg the police made free use of borrowed motor cars in order to reach distant points where disorder threatened. The use of the machines quickly established their value in such service, and soon thereafter three were purchased for the department. They are principally employed in patroling the city after nightfall, and their appearance is much dreaded by lawbreakers.

It is proposed to furnish motor bus service between Marietta and New Matamoras on the Ohio side of the Ohio River. The machines to be employed will have a carrying capacity for 12 passengers as well as room for baggage and light packages.

Motor cabs have been ordered for service in Indianapolis. A concrete garage is being built for the vehicles.

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SUPERIORITY OF CHICAGO'S MOTOR AMBULANCE

CHICAGO'S motor ambulance, the machine owned by the city, does the work of eleven horses and four of the old style vehicles. The machine is used in transporting patients suffering from contagious diseases.

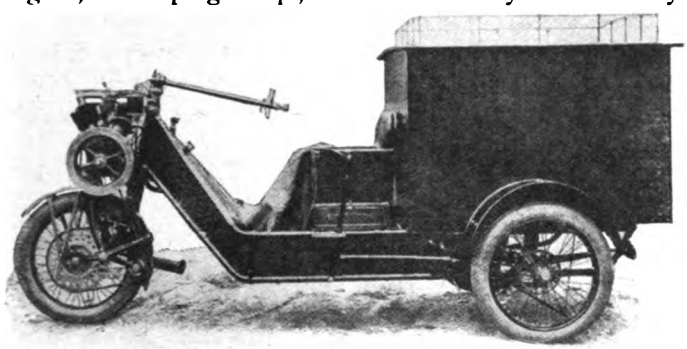
A further economy of the machine is the reduction its employment effects in the ambulance staff. Five drivers and four medical attendants have been dispensed with since the vehicle went into commission. Horses are now used only for short haul work. Recently the machine made a run of 54 miles, going to Hegewisch, Ind., for a patient and conveying him to the isolation hospital.

NOVEL UNDERGROUND TRANSPORTATION.

TWO motor buses are to be operated in the subway connecting the capitol and the new senate office building in Springfield, Ill., for the convenience of members of the upper house and visitors who may wish to pass between the senate chamber and its annex. Each machine will have a capacity for 10 passengers. They will be run on schedule time, each vehicle keeping to a track of its own and leaving ample space for pedestrians in the subway, which is 500 yards long.

INTERESTING PACKAGE CARRIER.

MANY vehicles like that shown in the accompanying illustration are to be seen in European cities. They are practically converted passenger tricycles and are used in light package delivery where speed is required. The engine, developing 8 hp., is of the two cylinder variety.



It is mounted on spring forks, the fly wheel being carried as shown. Power is transmitted to the front wheel by a single chain passing over pulleys and driving an epicyclic two speed gear. The speed changes, low speed brake, and clutch of this gear are controlled by twisting the handle of the tiller.

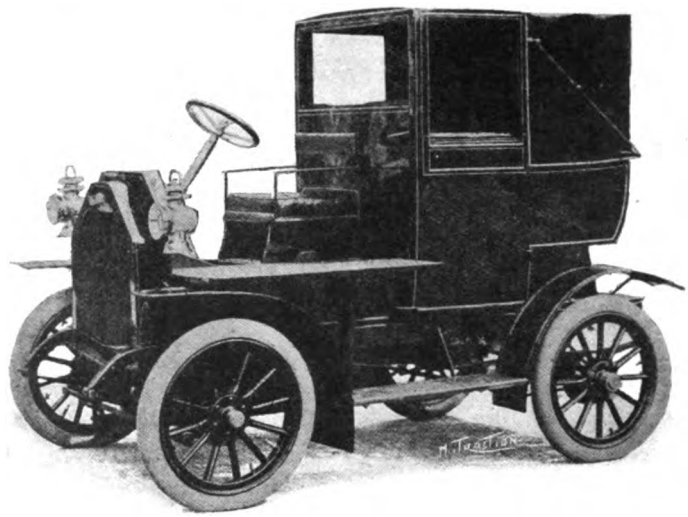
One of the Paris taxicab companies which in 1902 started out with cabs having steel-shod wheels, had an average of 7 per cent broken crank-shafts a year; the proportion on pneumatic tires was ½ per cent.

There are dozens of electric business vehicle installations which have been in existence for eight or ten years past.

Iron tired 1,500-pound electric wagons are to be seen, winter and summer, in Pittsburg.

UNUSUAL CAB DESIGN.

LACK of passenger room is a marked defect of the gasoline motor cab of the present day. By the time the designer has provided a short wheel base, located the engine under a hood and allowed space for the driver, there is little opportunity left for ministering to the com-



for of the fare. In short, existing cab design above the frame line is inconvenient and impracticable.

The accompanying illustration shows a vehicle which is admirably adapted to public service. The two cylinder engine is located beneath the floor boards, thus affording ample space for passengers. Ease of maneuvering in congested traffic is another advantage of this construction. The engine cylinders are set at an angle of 90 degrees to each other. The load capacity of the vehicle is very high, its rating being 1,500 pounds. This would seem to indicate that the machine is genuinely designed for commercial service, that is to say, for the carrying of baggage of passengers as well as their persons. Epicyclic gear is employed for transmission. The rear wheels are shaft driven. The engine develops 18 hp. The baggage board seen on the outside of the vehicle is constructed so as to fold. It measures 30 inches by 45 inches.

The building and operation of motor cabs is being considered in Savannah, Ga. A company with $350,000 is being organized.

Wood shod tractor wheels appear to be very useful in winter weather. One form of tread consists of 64 blocks of poplar arranged in four rows, the blocks being 4½ inches deep and set in the direction of the grain. The blocks are staggered, a half inch space separating the ends of each row.

An order for 100 motor cabs is about to be placed by a syndicate of Indian capitalists. The machines will be put in service in Calcutta, Bombay and other large cities.

The Paris municipal authorities favor the employment of single deck motor buses. The double deckers now in service weigh, empty, 4½ tons.

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MULTIPLE PNEUMATIC TIRES FOR BUSES.

MUCH interest attaches to the experiment being conducted in Paris with a motor bus equipped with triple pneumatic tires in the rear and duals in front. It is asserted that so far as the experiment has progressed the cost of maintenance for this form of tire equipment is not excessive.

The great weight of motor buses forbids the employment of single pneumatic tires. If, therefore, the pneumatic principle of cushioning load is to be made serviceable for such machines it is necessary to resort to the use of twins or triplets. The construction of single pneumatic tires will not successfully withstand a heavier rear axle load than 2,400 pounds, although special designs of this type of tire have been produced to carry a load of 4,000 pounds. At the latter weight, however, the cost of upkeep is enormous. Doubling the weight means a multiplication of the wear by eight. Increasing the weight by any more than 5 per cent causes an increase of 14 per cent in the wear. Of course the speed at which motor buses operate is of great importance in determining the load which may be imposed on pneumatic tires.

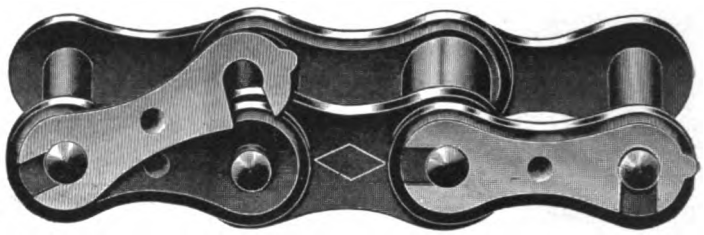
Pneumatic tires are not being tested in motor bus service solely with the object of ministering to the comfort of the public. The engineer views such equipment as insurance upon the life of the vehicle. The company which is conducting the experiment would doubtless not object to increased cost of tire maintenance if its effect was to reduce the expense of mechanical repairs and to guarantee that the vehicles would have a greater service efficiency. The earnings of a motor bus are of paramount importance. If inadequate tire equipment causes heavy expense for repair of mechanism, necessitating the frequent abstraction of the machine from service, it is quite evident that both gross and net earnings will be low. On the other hand, if the machines can be kept in commission even at the sacrifice of high tire maintenance, vehicle earnings will be large and constant and mechanical repair expense will be light.

This latter condition is the one which the General Omnibus Company of Paris seeks to establish. Its deep interest in the outcome of the present test may be inferred from the fact that of its fleet of 162 machines it is not now possible to keep more than 97 on the streets. Manifestly it would be unfair to wholly ascribe this low service efficiency to the solid tires with which the machines are fitted. Much better results are obtained by the motor bus operating companies in London, which employ many hundreds of machines not greatly dissimilar from those used in Paris. The substitution of pneumatic for solid tires will not remedy gear transmission troubles, or provide a sovereign remedy for all the mechanical disorders of a motor bus. It can only be expected that the load will be better cushioned by such an exchange of equipment, and that the effects of vibration, most apparent in crystallization, wear and misalignment, will be less severe.

There are four motor wagons used in the collection of refuse in Cologne, Germany.

DETACHABLE LINK CHAIN.

ANY link of the detachable chain made by the Diamond Chain & Mfg. Company may be removed, or a broken link in any part of the chain may be replaced, without the use of special tools. The thin strip steel lock on top of each outside link slips into a groove around the rivet surface and, turning on one rivet as a center, slips



down into a similar groove on the other rivet, thus preventing the sidebar proper from coming off. The strip is itself locked into position by being slightly warped inward, and having at its center an inward projection which snaps into a depression in the side bar. Once snapped into place, the strip can't change its position unless an intentional upward pressure is exerted on the clip at the end. The hole in the sidebar is so reamed that when the bar is pressed into position, there is perfect bearing contact between the rivet shoulder and the sidebar throughout the thickness of the bar.

THE EVOLUTION OF ROAD VEHICLES.

ALTHOUGH the principal purpose of the pamphlet recently issued by the Firestone company is to graphically describe the making of rubber tires, from the tapping of the forest trees for gum to the last factory process, considerable space is devoted to a pictorial description of the evolution which has taken place in road vehicles from the period of the Egyptian chariot to the machines of the present day. The story of rubber tire making is very instructively told. Copies of the pamphlet may be obtained without charge from the company's office in Akron, Ohio.

BIG TIRE MILEAGE.

AN affidavit was exhibited at the Boston automobile show testifying that a pair of Firestone rear tires, fitted to a gasoline truck owned by A. Goyert at Greensburg, Ind., had given 25,520 miles of service, while the front tires, also of Firestone make, had given service for 31,000 miles. Though badly worn on the tread the base of these tires still remains intact.

CHANGE OF FIRM NAME.

ONE of the oldest commercial motor vehicle manufacturing concerns in the country has changed its name. The Auto-Car Equipment Company, of Buffalo, will hereafter be known as the Auto-Car Manufacturing Company. Its capital stock will be increased to $250,000. It will occupy new quarters at Elmwood and Hertel avenues.

Of the 972 omnibuses in services in Berlin, 157 are mechanically operated.

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Wagon Maintenance

Tips to drivers and caretakers about things which are likely to escape their attention.

THE function of the carbureter is to mix in fixed and unvarying proportions such weights of air and gasoline that the resulting mixture shall be explosive. If the ratio between the two varies between too great limits, or, in other words, the mixture becomes too rich or too poor, the motor will either show less than normal power or will skip, which amounts to the same thing. The remedy for this is to properly adjust the needle valve, regulating the gasoline supply.

* * *

Carbureter Troubles.

A float will occasionally stick, causing a flooding of the carbureter. This is easily remedied by unscrewing cover to float chamber and freeing the float. A float made of cork may increase in weight after being used for some time, owing to the fact that it absorbs a certain amount of gasoline. This increases the richness of the mixture and also causes flooding. The remedy is to decrease the weight of the float, until the column of gasoline is flush with the top of the vaporizing nozzle. If the float is made of metal, and springs a leak, the result is the same, in which case it should be carefully soldered, using only just enough to stop the leak, otherwise the float will be made too heavy. Water in gasoline causes more carbureter troubles than any other one thing, and yet it is easily avoided if care is taken to see that all gasoline is strained through a chamois skin before being put in tank. If the motor misses and the cause is not due to poor ignition, the trouble may be located by removing the plug in the bottom of the carbureter and catching the contents in a cup. If any water is present it will settle as globules in the bottom. A large funnel in which is placed a chamois skin should always be carried; and make it an invariable rule never to use any gasoline that has not first been strained through it. By always adhering to this, much unnecessary trouble will be avoided. If a needle valve leaks it should be ground in its seat until a tight joint is obtained. All connections between cylinder and carbureter must be tight. If any of the joints become loose the mixture will become diluted, causing the motor to miss. These connections should be periodically gone over to make sure that all is tight. It often happens that a small particle of grit or dirt gets stuck in the vaporizing nozzle, either causing the motor to stop altogether, or seriously impairing its power. The nozzle should be removed and blown out. If the gasoline is carefully strained trouble from this cause will be avoided.

* * *

Frozen Water Jackets.

When the water is left in the engine in freezing weather trouble, of course, is expected, and if the frost be at all severe, trouble there will undoubtedly be. But it is rather galling after the water has been drained out of the radiator and engine to find that when the thaw comes the cylinder jacket is cracked after all. This happened on several occasions during the recent freezing spell, and more or less puzzled some of the sufferers, as they believed they had taken every precaution to run out all the water, of course opening the drain cocks on the cylinder jackets, and it is here they were deceived. Mud and sediment are apt to collect round the bottom of the water jackets, and as the water drains out of the jacket this sediment is very apt to stop the cock before all the water has been run off. The only safe way is to watch the water running out of the jackets, and directly it stops flowing the tap should be probed with a piece of wire. Nearly always more water will begin to flow, and directly it stops the tap should be probed again and again till no more water issues from it.

* * *

Examining the Brakes.

Sometimes the brake shoes, either on the countershaft or in the drums on the rear wheels, do not clear when the brake is released. Occasionally, too, the release springs are weak, or one of the connecting rods rubs against the frame. Or it may be that the brake shoes are covered with congealed oil, in which case they cannot clear the drum easily. The friction which is set up from one or other of these various causes not only hinders the speed of the vehicle, but sets up abnormal wear. It is no wonder, then, that the brake power is often found to be insufficient when most needed. In some cases the addition of a small pair of release springs on the rear brakes has proved very beneficial when the shoes are inclined to rub on the drum. But before trying this plan, the shoes should be examined in order to see that they work freely and are not impeded in any way. It sometimes happens that no mechanical cause for loss of brake power can be found, and so some other cause must be sought. Occasionally the fault arises from an abnormal quantity of grease on the shoes. It is really surprising at times to see the quantity that collects between them and the drums, as one would have thought that the heat would be sufficient to melt it. The rear brakes seem particularly liable to this trouble, as a great deal of grease often escapes through the live axle and settles on the drums. Road grit is soon picked up and burnt by the heat, so that a hard, compact mass is formed, which effectually destroys the checking power. Another reason for the falling off of brake power is that when the frictional surfaces are worn the shoes may not be able to make sufficient contact with the drums on account of some projection in their neighborhood. A close search will sometimes reveal a slight obstacle such as the edge of a nut or shoulder of a bracket that only needs easing off for efficiency to be restored.

The purchase of a motor hose and chemical wagon is being considered by the authorities of Springfield, Ohio.

A motor hose and chemical wagon has been bought for use in Long Branch, N. J.

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ARMY MECHANICAL TRANSPORT RECRUITS.

DRIVERS, repairmen and other artificers required for military motor wagon service are being steadily recruited in England. Rapid promotion is assured for those who have mechanical talent. Three months of strict military training prefaces other employment. The period of enlistment is twelve years, seven of which are spent in active duty and five in the reserve service. Machinists, blacksmiths, wheelwrights, electricians, molders, pattern makers, drivers, vulcanizers and draftsmen are badly needed to fill the ranks of the mechanical transport section of the service. No artificer is accepted unless he can pass the section workshop test.

Drivers are not rated as skilled labor and are, in consequence, only trained in their special duties. This point is worth noting, as it aids in deciding the nature of the work which should normally be expected of such persons under civil service conditions where many motor wagons are employed. However, should a recruit show special aptitude for artificer work he may apply for transference to the mechanical corps when a vacancy exists. There are eight ratings and four classes for drivers, the sergeant in charge of a detachment heading the list. There are four ratings and three classes for artificers. The pay of the corps is regulated by the efficiency and deportment of the men. The age for enlistment is fixed between 18 and 35.

MOTOR WAGON PARADES.

AS the season for automobile parades approaches fresh occasion is afforded for noting how important a part the business machine has come to assume in such ceremonies. This year the commercial motor vehicle division will be larger and more varied than ever. In the New York parade it is expected the showing will be so extensive as to excite general surprise. At the last meeting of the carnival executive committee it was decided to seek the co-operation of the establishments which make, sell and employ motor wagons. Motor cabs will also be represented. Prizes will be awarded to the owners of the machines which make the most creditable appearance.

MECHANICAL STREET SWEEPER IN NEW YORK.

TRIAL is being made of a motor driven street sweeper in New York City. The machine is equipped with a 40 hp. engine. The street commissioner is of the opinion that the municipality could very well afford to invest in a number of machines of this character, but before making such a recommendation to the council he is desirous of fortifying himself with facts and figures concerning their economy in operation.

In Hamburg passengers are not permitted to sit alongside the driver of a motor cab. Violation of this police regulation is punished by a severe fine.

Licenses are not issued in Munich for heavy motor wagons equipped with iron tires. All such machines are rubber shod.

RELIANCE STOCK CONTROL IN NEW HANDS.

THE stock control of the Reliance Motor Truck Company, of Owosso, Mich., is now held by William C. Durant, vice-president of the General Motors Company, the latter a holding concern which controls the stock of the Olds Motor Works, the Buick Motor Company and a few parts producing concerns. It is not believed, however, that the Reliance Company is under the domination of the General Motors Company. On the contrary, it is unofficially stated that Mr. Durant's investment in its securities is for his own personal benefit.

The Reliance Company is now amply financed, having, it is said, the sum of $200,000 available as working capital. Mr. Durant intends to erect two new factory buildings in addition to that which is now being built. In one shop the 1 and 1½-ton models will be made, in another only 5-ton machines will be built, while the models rated to carry between 3 and 4 tons will be manufactured in the building now in process of erection.

REGULATING SUPPLY OF GASOLINE CABS.

WITHOUT warning, and greatly to the commercial disadvantage of manufacturers and proprietors, the Berlin police authorities have given notice that no more motor cabs fitted with gasoline engines will be licensed for service. No explanation is given of this drastic measure other than an intimation that the supply of such machines is in excess of the demand. Operating companies which have placed orders for recent vehicle patterns are both amazed and disgusted with the ruling. Manufacturers having orders for such product are equally incensed. The ruling apparently does not apply to the employment of electric cabs. The manufacturers' association, the national motor club, and the trade interests generally have, as might be expected, protested violently against such action, but up to date have only succeeded in persuading the police authorities to consider applications for gasoline cab licenses as they are presented without any assurance that they will be granted.

EXTENSIVE MOTOR BUS SERVICE.

INTERURBAN bus service between Marquette, Negaunee, Ishpeming, Presque Isle and other points of interest near the three cities first mentioned will be commenced this summer by the Marquette County Traction Company. The company, with capital stock of $30,000, has been formed to operate six machines, each capable of carrying 20 passengers. The vehicles will be supplied by the Grabowsky company.

The authorities of Mankato, Minn., are considering the purchase of a motor hose and chemical wagon.

Myerstown and Womelsdorf, in Pennsylvania, are to be supplied with motor bus service. The route is seven miles in length. The machines to be used will have capacity for 16 passengers and light freight.

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The Power Wagon

A Journal for Those Employing Commercial Motor Vehicles

No. 54 MAY, 1909 No. 54

PUBLISHED THE FIRST OF EVERY MONTH BY

THE POWER WAGON PUBLISHING CO.

SUBSCRIPTION RATES:

One Year (Domestic)	$2.00
One Year (Foreign)	3.00
Single Copies	.20

PUBLICATION OFFICES:
THE METROPOLITAN BLOCK
Chicago, Illinois.

Advertising Rates on Application

WALTER WARDROP, Editor

Entered as Second-Class Matter December 2, 1907, at the Postoffice at Chicago, Ill., Under the Act of Congress on March 3, 1879.

Agents Should Organize

Irregular work methods produce many trade abuses and superficial education of the public

DEALERS in commercial motor vehicles are beginning to find out that the surest guarantee of success is co-operative campaigning in all matters affecting the common welfare. The lack of organization has occasioned many abuses which it will be well to check before they strike deeper root. But chiefly does it prevent retailers from intelligently combating the inertia and prejudice of the public.

One in position to review the entire industry is frequently amazed at the highly competitive trade feeling which exists at a time when the sale of commercial motor vehicles may be said to be in a state of extreme youth. Undoubtedly the novelty of the product and the general excitement which attends its introduction accounts for much of the irregularity in the methods employed for its distribution. But it is commercially acceptable at the present time, and the methods used for its release to the public should be correspondingly standardized.

* * *

The harshest critics of the motor wagon are inside of the trade and not outside of it. Each producing concern is intent upon the sale of its own machines, and seems to regard it as a matter of duty to belittle those made by competitors. While it is not to be expected that the makers and sellers of the three principal types should dwell together in perfect amity, it is well to reflect upon the consequences of making the public umpire of disputes over construction and design. Usually a referee is chosen on account of known competency to decide between parties at strife with each other. Are inexperienced buyers of motor wagons equipped to pronounce judgment upon mechanical and administrative problems which test the capacity of the wisest of those who have made and used such machines?

Many buyers of commercial motor vehicles have had the misfortune of being superficially educated by the representatives of concerns which are seeking their custom. They use the language of the technical expert, ascribe all virtues to a design which pleases them, condemn as heartily as they praise, talk eloquently about engineering principles, and yet are ignorant of their horse transportation costs. Many of the sellers, we regret to say, are not much better equipped. They possess knowledge of the capacity and the merits of their vehicles, but they know little or nothing of the conditions under which draft animal transportation is carried on. The inexact and artificial bookkeeping to which they often resort in order to have the power wagon appear well before economists, would seem to confirm opinion concerning the unpreparedness of the trade for the great work in front of it.

* * *

The New York dealers realize the comparative weakness of the foundation upon which they are trading, and are resolved to strengthen it. They are about to form an association for the regulation of private abuses and the acquisition of reliable information pertaining to every detail of horse and mechanical haulage. Sale methods are to be revised; trade discussions and lectures will be held upon topics of local and general interest; demonstrations will be of limited duration and made at uniform fees for vehicles of all ratings and types; accurate and full records of service performance will be kept and used for common advantage; in short, the business of selling machines is to be systematized and shorn of the haphazard methods which now characterize it.

Dealers in other large cities should note the intention of their brethren in New York and if possible endeavor to improve upon the course of policy outlined. The users of motor wagons might be organized, as they are

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abroad, and close relations sustained between the two bodies.

* * *

At this moment there is rather more curiosity than deep concern shown in the operation of commercial motor vehicles. This is the result of permitting the novelty of their application to assume more importance than their economy in service. Millions have witnessed the interesting work which is being accomplished by power wagons, but there is precious little information current concerning the economic advantage of it all. This is the more remarkable considering the numerous instances in which the machines are known to be well and profitably employed. Making all due allowance for the difficulty which experience shows is encountered in procuring this information, the fact still remains that it has not been sought with enough persistency. An association pledged to respect the confidence of satisfied users of motor wagons might easily secure abundant proof of the machine's economy, which is now denied to individual selling firms. In spreading such proof before the public great care should be exercised in order to make the evidence convincing. This can only be accomplished by thorough comparative accounting. It is a waste of time and an inexcusable folly to resort to artificial bookkeeping in order to establish the superiority of motor wagon transportation.

* * *

There is good reason for believing that a very profound interest could be created in the work of the power wagon if trade associations should undertake to conduct demonstrations upon a scale of magnitude calculated to impress the commercial world. To accomplish this, however, it would be necessary to insure equal opportunities for all types and classes of vehicles, and so completely perform the transportation service of certain important branches of industry that even the most skeptical would recognize the superior advantages of mechanical road haulage. In the past such demonstrations have been characterized by two defects. They have not indicated how the machines would behave in established commercial service, and as a result the public has been unable to distinguish real from false values. The conditions under which the vehicles operated have not been such as exist in business. In giving private demonstrations, manufacturers have spent immense sums of money. These private trials have made many converts, but it is impossible to think that they have exerted any great influence upon the mass of buyers.

* * *

Mass demonstrations would seem to promise better results. It is conceivable that prominent merchants would not object to having a large part of their transportation experimentally performed by motor wagons for the period of a month if during the course of the demonstration they were guaranteed against interruption of service, and at its close could expect an accurate comparison of the cost of operating machines and horses. As a result of these mass demonstrations permanent and well authenticated records would be created which would be available for manufacturers whenever there was occasion to prove that the power wagon, under given conditions of service, was as economical as represented. The accounting could be undertaken by experts representing both interests.

* * *

Summing up, the situation amounts to this: The public needs real and not artificial enlightenment pertaining to motor road transport of all kinds, which the trade is expected to furnish. The trade, too, needs education, especially with respect to the cost of horse transportation and all the conditions which surround it. The initiative in providing such knowledge must come from the sellers.

FREIGHT DEPOT LOCATION.

SEVENTY per cent of the rail freight received in Chicago is consigned to points beyond that city. But as it is the practice to receive all such freight within the city limits there is great confusion, delay and congestion.

As a remedy for this state of affairs it is proposed that a central freight distributing yard be established and maintained outside of the city by all the roads which enter it. In this yard all incoming freight could be received, stored and redistributed for shipment. All outgoing freight, originating in Chicago, could also be handled from this central depot. If such a system were to be put into effect it would no longer be necessary for shippers to deliver merchandise to the freight houses of the particular roads which are selected to carry it to destination.

The usefulness of motor wagons would be very conspicuous if the proposed reform could be accomplished, especially if special platform loading facilities were to be provided for such vehicles. As matters stand at present the haulage of depot freight is a form of service which adds nothing to the machine's reputation for economy. In such work it operates under conditions which are peculiarly well suited for horse transportation and correspondingly disadvantageous for machine trucking. The delays in maneuvering for position are very costly, and the loading and unloading practices extremely primitive. All this would be advantageously changed by separating the two classes of road transportation and assigning special depot conveniences for each.

This method of relieving freight congestion is suggested by a veteran railroad man of wide experience, who is familiar with all phases of the great problem for which he offers a solution. He says with truth that the cost of handling tonnage in Chicago should be less than that in any other large city of the country. The physical problems which Chicago encounters are distinctly simpler than those with which other large cities have to deal in providing transportation facilities. Doubtless wise co-operation by the railroads, in accordance with a well-wrought plan approved by the Chicago public, would lower greatly the cost of receiving and shipping freight, and would relieve congestion in the streets.

Two 3-ton gasoline trucks have been shipped to Honolulu. They will be used by one of the largest canning establishments on the island.

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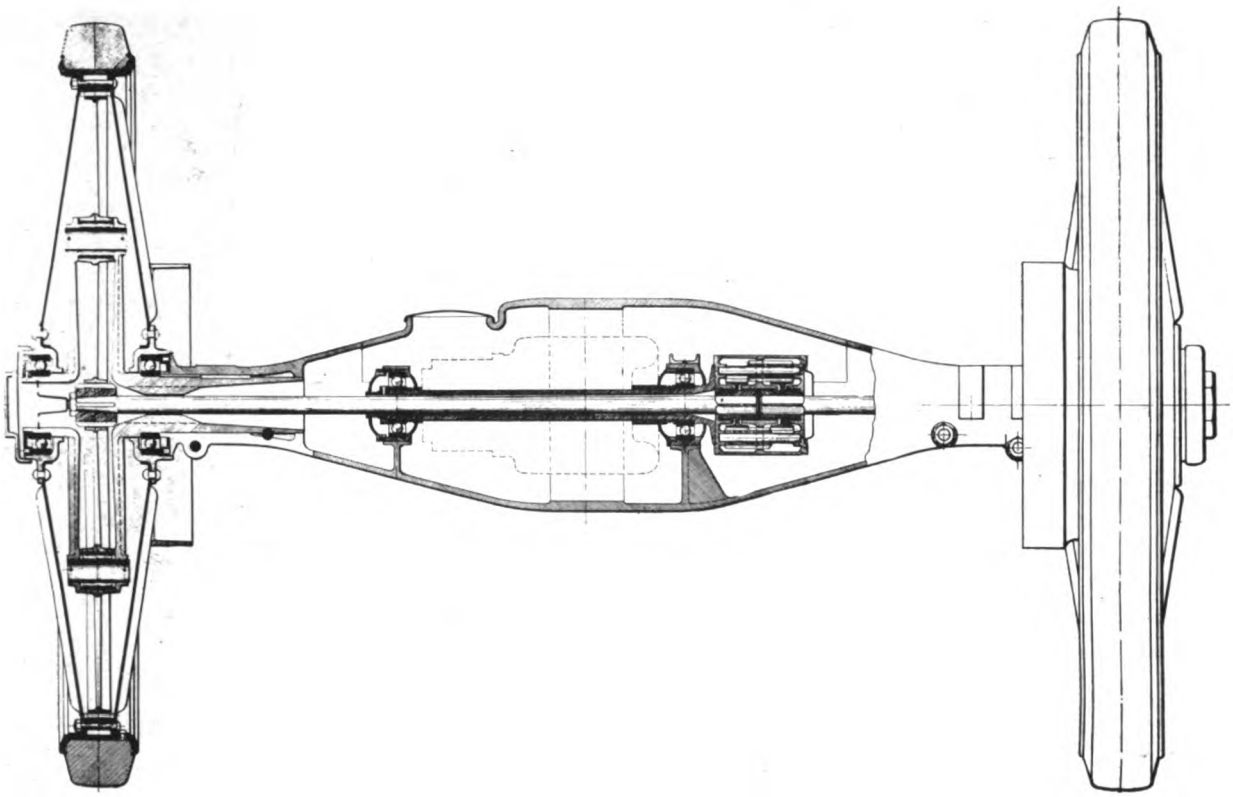


Rear Axle Assembly of Walker Balance Gear 1½-Ton Electric Wagon.

Improved Electric Wagon Design

Transmission losses much reduced by the use of a driving mechanism known as the Walker balance gear

HIGH mileage on a single battery charge, low current consumption and low maintenance cost are the characteristics of the 3,000-pound electric wagon made by the Automobile Maintenance & Manufacturing Company, of Chicago. The principal factor in obtaining these advantages is a patented driving mechanism known as the Walker balance gear.

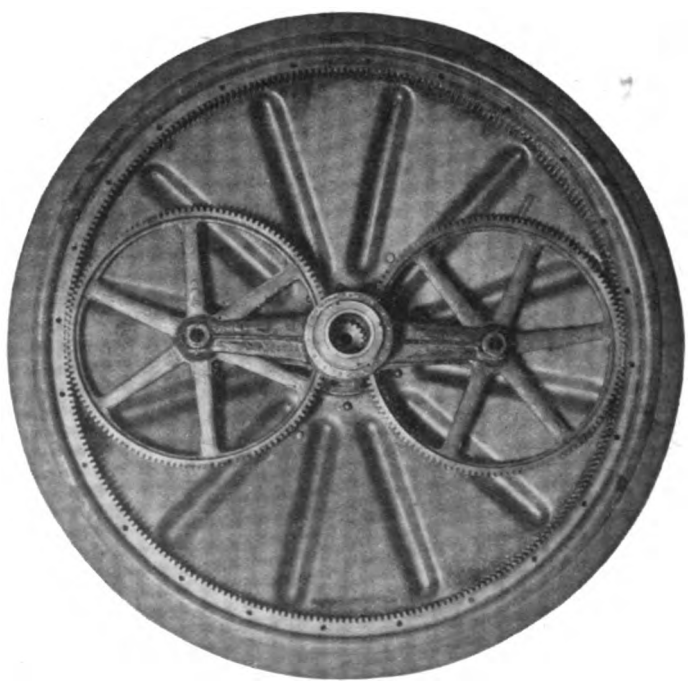
* * *

This driving mechanism consists of a combined motor housing and rear axle made of cast steel. A portion of the upper half of the housing is made removable in order to afford ready access to the armature and differential. The ends of the housing are bored out to admit cast steel yokes which support the rear wheel bearings and hold the idler gears which are placed between the driving pinions and the large internal gears mounted on the tire channels.

The rear wheels are made of ribbed sheet steel discs, so mounted that the hollow space between them is available for the driving gears and idler gear yoke. A photograph of one of the rear wheels is shown, the outside disc being removed.

The wagon is provided with four forward speeds ranging from two to fourteen miles per hour. It is equipped with a 3½ hp., 80 volt motor. The wheels are 36 inches and 42 inches in diameter, front and rear respectively, and are furnished with 3½ inch solid tires. The gauge is 56 inches and the wheel base 88 inches.

The assembly drawing of the motor axle and driving mechanism shows the method of transmitting the driving power from the armature to the rear tires, and it requires but a moment's study of the drawing to understand the simplicity and practicability of this gear arrangement. All gears are of the spur type and run in an oil bath. There is no side thrust on either the armature



Driving Gear Mechanism Enclosed in Oil Tight Wheel.

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or wheel bearings, the power transmitted by the driving pinions being equally distributed to the idler gears, which in turn equally transmit it to the internal gear mounted on the tire channel. Power is thus transmitted from the armature practically without loss to the rims of the driving wheels, and through mechanism entirely encased in dust and oil tight compartments. There is no chance for driving shafts to become sprung, as there can be no side thrust upon them, and for the same reason bearings will have an indeterminate life. Driving gears, owing to the fact that they run in oil and always on the pitch line, will last for a number of years before replacements are necessary. These features mean a great deal to wagon owners, as they insure the maintenance cost of the driving mechanism at minimum.

* * *

Three of these wagons are used in the service of the Commonwealth Edison Company, of Chicago, giving the utmost satisfaction. One of them makes two round trips from the center of the city to Evanston, and averages close to 50 miles a day. The newly designed vehicles show better records than the firm's older ones, so far as maintenance cost and mileage on a single battery charge are concerned. This is because the new models weigh 10 per cent less and run on 25 per cent less current.

In the view of the rear wheel, with outside disc removed, the small driving pinion is directly in line with the armature shaft. With the outside wheel disc in place, a small amount of oil is placed in the space between the discs, and at every turn of the wheel the gears and bearings are flooded with oil. It should be noted that the wheels themselves, that is, the discs and hubs, are not subject to any driving stresses, as is the case in all other power driven vehicles. The differential is of the spur gear type, and from its driving gears floating divided drive shafts extend from both sides to the center of the rear wheels. Each shaft carries at its extremity a spur pinion which drives the idler gears.

The importance of accessibility has been fully realized, and all parts liable to be removed are so easily accessible that their removal is only a question of a few minutes' work, by even an inexperienced man. To illustrate this, it is only necessary to mention the fact that the armature of the motor can be taken out in fifteen minutes and also replaced in the same length of time. Either of the driving pinions with shaft can be withdrawn in two minutes. The commutator and brushes are open for inspection and adjustment by simply lifting the cover above them.

* * *

At present the Edison company has fourteen 1½ ton electric wagons in service. Eleven of these are of the double motor, exposed gear drive type, the remainder being of the new Walker balance gear type. All of these machines have been built by the Automobile Maintenance & Manufacturing Company, which for six years cared for the vehicles of its customer. Last May the Edison company decided to operate its own garage, and ever since has performed all the work incidental to battery upkeep and

Rear View of Walker Balance Gear Electric Wagon.

Front View of Walker Balance Gear Electric Wagon.

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repairs of its machines. The Maintenance company's management now acts in an advisory capacity only in matters pertaining to the operation and care of the wagons.

The Edison company's machines are chiefly used for delivery service, operating from the company's storerooms. Some are used as emergency repair wagons, while a few are equipped with electrically driven cable pulling winches. The service of these latter vehicles is especially economical.

* * *

That the Edison company's old type of electric wagon was of superior design is shown by the records of the past three years. These records are kept with a precision which it would be greatly to the advantage of all commercial establishments operating electric wagons to imitate. There is nothing in the accounting which is overlooked, while, as might be expected, those features of the records dealing with electrical upkeep are more than ordinarily complete and analytic in character. Advanced administrative practices have been responsible for the unusually long life of battery plates and a range of travel on a single battery charge far beyond the average. The company's statistical tables show that negative plates are now in service in several batteries which have propelled their 3,000 pound wagons from 12,000 to 15,000 miles. Under the same conditions which governed when these figures were obtained the positive plates have given from 10,000 to 11,000 miles before replacement became necessary.

* * *

It will be news to a great many concerns which lament the constant incidental expense which often attends the upkeep of batteries, to know that with the exception of new plates the cost of the Edison company's electrical expenditures have been so small as practically to be negligible.

ANOTHER BIG CAB COMPANY IN NEW YORK.

AS a foundation for future business the W. C. P. Taxicab Company, of New York City, has decided to operate 75 machines by June 1 and 200 by September 1. Deliveries are expected at the rate of three a day. The vehicles will be the product of the Bristol Engineering Company. C. F. Wyckoff, E. S. Partridge, A. F. Rockwell, F. E. Moskovics and DeWitt Page are the chief factors in the enterprise. Recording instruments will be attached to the front wheels. The garage will be located at 232 West 56th street. Only carefully trained drivers will be employed. The color scheme of the vehicles is orange and black, which will readily distinguish them from other public service vehicles of the same character.

Motor bus service is being supplied between Lewes and Rehoboth, Pa.

A 22-passenger motor bus will be employed between Mt. Airy and the end of the Colerain avenue route of the Cincinnati trolley system.

EXPERIMENT IN ARMY TRANSPORT.

HUNDREDS of motor cabs and touring cars, and 29 motor wagons, were recently employed in moving a battalion of troops and military supplies for a distance of 54 miles in England. The journey was accomplished in a little more than three hours.

The force transported was supposed to be sent to a garrison town which had become beleaguered and stood in need of immediate aid in consequence of the disorganization of its railroad connections. The troops, which numbered 1,050, were conveyed in 286 machines. Reserve ammunition, entrenching tools, ambulance stores, machine guns and complete water carts were transported by the motor wagons, some of which hauled 7-ton loads. The heavy vehicles consisted of 21 light wagons, 5 lorries and 3 three-tonners. One spare wagon was assigned to the heavy section.

Twenty-five of the touring cars were temporarily disabled by punctures to the pneumatic tires with which they were equipped. The crew of a traveling workship, which accompanied the column, proved of great assistance in remedying such troubles as arose.

Nothing really useful was learned as a result of the experiment, beyond what is already well known. The inappropriate character of the machines employed in dispatching the troops, the unnecessarily large number of units employed, and their capacity for high speed, suggest that the means and methods were not well chosen.

PRIZES FOR PARADE VEHICLES.

VALUABLE prizes are offered the owners of commercial vehicles in the automobile parade occurring May 1 in New York City. The first award is $500, the second $200, and the third $100. The industrial section is to be composed of wagons, trucks and machines which may be used for display advertising purposes. The parade will form on 84th, 85th, 86th and 87th streets, east of Broadway. The line of march is north on Broadway to 118th street, south on Broadway to 48th street, east on 48th street to 5th avenue, north on 5th avenue to 110th street, and disband. The judges will be located on the parking strip at the corner of Broadway and 92nd street.

SHAFT DRIVEN ELECTRIC WAGON.

MANY interesting features of design are contained in the new 1,000-pound electric wagon designed by the Commercial Truck Company of America. The machine, which weighs 3,000 pounds and has a speed of 15 miles an hour, is shaft driven. The gears are enclosed and run in an oil bath. The controller is mounted around the steering post and is operated by a hand wheel placed below the steering wheel. The gear box, containing spiral drive, and the rear axle form a single unit. The front wheels are 36 inches in diameter; the rear wheels are 40 inches in diameter.

The P. G. H. Auto Delivery Company has been formed in Camden, N. J., with capital stock of $125,000.

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HAULING 18 1-2 TONS BY MOTOR TRUCK.

THE hauling capacity of a motor truck can only be very imperfectly estimated by observing it transport loads suitable to its rating. The machine's great usefulness as a tractor is only occasionally made evident, but whenever it is well applied in such work its performances are very remarkable.

Quite recently the 5-ton truck made by Ralph L. Morgan, of Worcester, Mass., carried 4½ tons on its own platform and pulled a boiler weighing 11 tons mounted upon a trailer weighing 3 tons, the total weight hauled being 18½ tons. This feat was brought about by the intimation of the boiler maker that 14 or 15 horses would be required to transport it to destination. Mr. Morgan volunteered the use of his machine and towed the great load at a speed of 3 miles an hour for a distance of 5 miles. The illustration on this page shows how the service was accomplished.

MOTOR MAIL WAGONS IN NEW YORK.

FOUR electric wagons are now being employed in mail collection and delivery in New York City. The installation of these machines marks the first attempt on the part of the metropolitan postal authorities to ascertain the inferiority of horse service. Half hourly trips are made between College station, station M, and the Washington bridge station. A little later the service will be extended to station J at 8th avenue and 124th street, where connection can be made by pneumatic tube with the Grand Central station or the general postoffice. The postmaster is of the opinion that the new method of delivery and collection will prove highly successful, and that in consequence it will be necessary to use many more machines than are now in service.

A San Francisco ordinance prohibits drivers of wagons from stopping on the left hand side of the street. The measure also compels the drivers of slow moving wagons to pull to the curb in order to make way for speedier vehicles.

Philadelphia is to be provided with motor police wagons.

TO QUIT BUYING HORSES.

THE higher officials of Tacoma, Wash., are thoroughly convinced that it is bad public policy to continue the use of horse-drawn fire apparatus. This opinion was formed after the commissioner of public works and the president of the city council had paid a visit to Vancouver, B. C., and obtained proof of the economy and superior efficiency of the motor propelled apparatus with which the fire department of that city is provided.

"After looking into the matter," says the commissioner, "any sensible man will admit that the most practicable thing to do is to purchase automobile apparatus in the future. While the first cost is a little more, the cost of operation and maintenance is far below that of the horse-drawn vehicles.

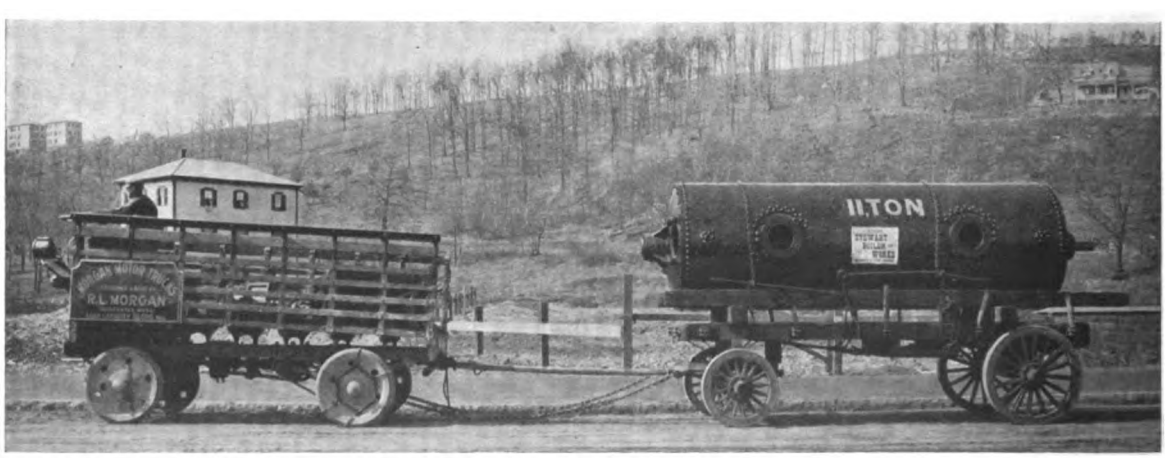
"For comparison we will take a 20-year period. The cost of a horse-drawn hose wagon or chemical engine at the end of 20 years amounts to $50,760. The cost of a motor vehicle for the same period amounts only to $16,600. The time has come for Tacoma to quit buying horse-drawn fire engines. I think that in purchasing future equipment we should confine ourselves to the new kind of apparatus."

TUNNEL TRANSPORTATION IN WASHINGTON.

THE electric buses operating in the tunnel at Washington, D. C., which connects the capitol building with the legislative offices, travel over a concrete roadway which is sufficiently wide to accommodate the passage of two machines. The passenger sidewalk is fenced off by an iron railing. The machines attain a speed of 12 miles an hour. The round trip is made in two minutes. Going one way the machines climb a grade; returning they practically coast. Moving down grade the machines run backward, not being turned around upon the completion of the ascent. There are two seats for the driver, one at each end. The passenger seats are arranged along the sides. The vehicles carry ten passengers exclusive of the driver.

The Auto Commercial Company, of Detroit, has been organized with capital stock of $8,000.

Test was recently made of a light motor wagon in the postal service at Akron, Ohio.



Morgan Five-Ton Gasoline Truck Hauling a Load of 18½ Tons.

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Work of Steam and Gasoline Trucks

Record of experience with a five ton steamer pulling a trailer, and two lighter gasoline vehicles

NO available record of motor wagon performance establishes the superiority of any one type for all conditions of service. Remembrance of this well proved statement will prevent inexperienced buyers from accumulating a stock of prejudice with respect to the economy of any of the types now on the market.

While the frequency with which inquiry is made concerning the "best" motive power for commercial vehicles alone would furnish a sufficient excuse for making this declaration, its presentation becomes a special duty when the work and operating cost of two distinct types are laid alongside of each other. The speed of the heavy steam wagon, for instance, is never as high as that of a gasoline machine of the same rating. The slow motion of the former is the deliberate choice of the designing engineer, who usually builds it to travel on steel tires, and if, as often happens, it pulls a trailer, its rate of travel is further limited. The chief purpose of records of power wagon performance should not be to contrast motor with motor, but to show how greatly superior mechanical haulage is to draft animal transportation.

* * *

The machine's superiority was well demonstrated in a paper recently read before a large gathering of foreign grocery store managers. The author is the traffic manager for a large co-operative society which employs a considerable number of horses. Many of his utterances may appear elementary to experienced users of motor wagons, but they can be tolerated for the more valuable opinions and suggestions with which they are accompanied. The address follows:

I can, with every confidence, recommend a commercial motor as an expeditious and economical investment to those who may have facilities in the shape of mileage and tonnage for goods to be carried in bulk. Much harm has been done by enthusiasts making exaggerated claims impossible of substantiation, but I can assure you that the figures given by me are a fair and just record of the cost of running our machines; if anything, the tendency has been to err on the disadvantageous side throughout. My audience will be able to form their own opinions of my estimates by comparing them with their own costs of cartage by horse vehicles, and if on examination you find that you can, after allowing for *all* charges on your horse outfit, convey goods at the same rate per ton-mile and give the same facilities for early and expeditious delivery with horses, I would say, "let motors alone." On the other hand, if you find that the estimates given are the cheapest (and I hazard a guess that you will), then by all means give the subject your serious consideration, and arrange for a reliable firm to give you a fortnight's demonstration in the actual work that your vehicle would be required to do.

* * *

In dealing with the working of motor vehicles for trade purposes there are certain general rules governing success, whether the motive power employed be steam, gasoline or electricity. In the first place, the prospective purchasers should not allow themselves to be influenced to any degree by previous experience in the running of pleasure cars. The working conditions are very much more severe for the trade vehicle, so that the methods eminently suitable to the private car would be undesirable when applied to a motor wagon working day in and day out at its maximum limit of efficient capacity. One of the first necessities, therefore, lies in taking the greatest care to have a really capable man to supervise the working of the vehicles, for many motor-owning firms, merely from neglect of this principle, have failed to obtain the best results.

Another important factor which, if it is not carefully guarded against, may do a lot of harm is the great tendency to overload a motor vehicle. The despatching departments of some concerns are not always, in this respect, too humane towards their horses, let alone towards their mechanical wagons. The motor, in consequence of its being unable to complain, gets taken advantage of, and, having to travel at the speed it does, resents overloading in a way that touches the pocket more seriously, especially as regards tires, gears and general mechanism, than the overloading of horse vehicles with iron-rimmed wheels.

* * *

One of the most important points in connection with the working of trade vehicles, if success is to be insured, is their employment on suitable work. It is unnecessary to harp on the folly of keeping idle a machine representing the capital cost of several horses and vans, and it should not be requisite to point out the inadvisability of small loads and "dodging" about the country with frequent stops. What is wanted is a state of things as near as possible to the ideal. Now the ideal work for a motor vehicle would consist of a non-stop outward journey of nearly half-a-day's duration, and a return trip, with full loads both ways. Of course, such conditions are very seldom obtained in practice.

I will take the five-ton steam wagon first, the construction of which has been brought to a very high standard of perfection. This type of vehicle is very economical, where it can be fully occupied and every advantage taken of its carrying capacity. Seeing that it is capable of hauling a trailer laden with two or three tons, in addition to its platform load of five tons, and can travel at five miles per hour, it would require a concern of some magnitude to keep it fully employed, and it is only by these means that the best working results are obtained. This is not the type of vehicle for a small company, since one of these engines, in the hands of a capable man, with good organization in the forwarding department, can average 25 miles per day, that is, two journeys of 12½ miles each, laden each journey with seven tons, and one trip on alternate Saturdays, the Saturday intervening being utilized for the washing of the boiler, cleaning, adjusting, etc. The costs are based on the vehicle's being loaded one way only, but, where arrangements could be made for a return load this tonnage would be considerably increased, and the cost per mile thereby very much reduced. Goods carried by this method on ordinary roads, care being taken to see that the vehicle had prompt loading and unloading facilities, would cost about 6 cents per ton-mile. In my table of figures six days have been allowed for running time lost through frost and snow, which I consider ample, on the average, for six months.

* * *

How many know exactly what it really does cost per ton per mile to carry goods with horsed vehicles? I fancy not many. All, I have no doubt, can tell what the care and feeding of the horses totals, and what wages are paid to the drivers, but how many really bring in all expenses or allowances for interest on outlay, insurance, depreciation, etc., which are completely covered in my table showing the cost per mile of motor haulage.

In the working costs of the steam wagon, I have made allowance for days lost, caused by frost and snow, but this is unnecessary in the case of the gasoline motor; the fact of its being shod with rubber tires enables it to travel in all weathers, which is a very strong point in favor of rubber-tired vehicles, apart from the enormous advantage of extra speed. By introducing a gasoline motor, let us see what one gets; more expeditious delivery of

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goods, which means greater satisfaction to customers; the ability to do extra work upon all occasions, and to extend the area worked by opening up new districts; the uncertainty and trouble of horses is avoided; a far better advertisement than a horsed vehicle; proof that one is alert in adopting up-to-date methods; and an almost certain increase in trade, resulting from the extra-facilitated conditions of delivery. Are not these sufficient and ample justification for the adoption of the motor? I think they are to the average firm, and I am of opinion the comparison is in no way exaggerated.

* * *

"What will it cost us to introduce a two-ton or three-ton motor?" is the first question which the business man asks when it is suggested that he should replace his horse outfit. The original outlay, to my mind, is not the all-important item, but the cost per ton-mile to deliver the goods. Consider how many horses would be required to perform the task I have shown for the three-ton lorry. A firm may be situated in a district with fairly level roads, enabling its horses to deal with 3,000 pounds per horse; so much better for the motor—it would require less engine power per ton carried. The figures given, however, are for a motor working in a very heavy district, where steep gradients have to be negotiated daily, and they by no means represent an extraordinary day's work. but a task that can be performed easily. The gasoline vehicle under consideration is capable of maintaining an average speed of 12 miles per hour with its full load of three tons. This type of engine is now constructed with a winding arrangement for the hoisting of flour, grain, sugar, potatos, etc., into upper stories, thus providing a quick means of unloading and a saving of labor, given average facilities for loading and unloading. The figures speak for themselves.

* * *

I now come to the two-ton gasoline lorry, and from experience gained I should venture to suggest that this type is the most suitable vehicle to meet the requirements of the average firms as an expeditious and economical motor. Given an adequate engine of reliable make, and this placed in the hands of a capable driver and assistant, its capabilities are, practically speaking, unlimited. Many firms only employ one person on each vehicle, but where many calls have to be made in a day it is an advantage to have the assistant to look after the goods in loading and unloading and the signing of receipts, etc. He would also prove to be of some assistance in the guiding of the driver where narrow roads and places difficult of access have to be negotiated, while, if the driver be engaged on the terms that he teaches the assistant to drive, one always has someone to fall back upon in case of accident or illness.

The particulars show that only 3,500 pounds has been the average load and for this reason: when the vehicle was engaged in the conveyance of meat, bread, etc., the load probably would not exceed one ton, but by being light laden it would be enabled to travel faster and thereby place the fresh meat, bread, etc., on sale so much earlier. This vehicle maintains an average speed of 16 miles per hour.

As regards tires, I have made liberal allowances for these. Several makers will now supply tires with a guarantee of 10,000 miles, or they can be hired at so much per mile run according to the class of work required of them and the weight carried. It is advisable to have a spare front and back wheel, as this obviates any delay in waiting for the re-tiring of wheels.

* * *

TABLE OF WORKING COSTS.

FIVE-TON STEAM WAGON.

Six months' running costs of a five-ton steam wagon carrying an average load of seven tons with trailer, making two journeys of 12½ miles each per day. Allowance is made for six running days lost through frost and snow, also half-day holiday per week and every alternate Saturday taken up by cleaning, adjusting, etc., thus making 130 full working days. Initial cost of vehicle, $2,400.

Wages: Driver 26 weeks at $9.40	$218.40
Two assistants, 26 weeks at $5.96	299.52
Fuel (coke)	76.80
Oil	33.60
Repairs, accessories, etc	96.00
Insurance (boiler)	3.84
Registration	4.80
Interest at five per cent on $2,400 for six months	60.00
Depreciation at 20 per cent on $2,400 for six months	240.00
Total	$1,032.96

Summary: Carries 1,820 tons; travels 3,250 miles; cost per mile, 31 cents.

TWO-TON GASOLINE LORRY.

Six months' running costs of a two-ton gasoline lorry carrying an average load of 3,000 pounds, making four journeys of 15 miles each per day. Allowance is made for half-day holiday per week. Also one half-day per week for cleaning, adjusting, etc., thus making 130 full working days. Initial cost of vehicle, complete with tires, $2,400.

Wages: Driver, 26 weeks at $9.40	$218.40
Assistant, 26 weeks at $5.96	149.76
Gasoline; 7,800 miles (12 miles to gallon) at 18 cents	117.00
Oil and grease	24.00
Repairs, accessories, etc	96.00
Tires at 4 cents per mile	312.00
Registration	4.80
Insurance	38.40
Interest at five per cent on $2,400 for six months	60.00
Depreciation at 20 per cent on $2,400 for six months	240.00
Total	$1,260.36

Summary: Carries 910 tons; travels 7,800 miles; cost per mile, 16 cents.

THREE-TON GASOLINE LORRY.

Six months' running costs of a three-ton gasoline lorry carrying an average load of three tons, making four journeys of 10 miles each per day. Allowance is made for half-day holiday per week, also one half-day per week for cleaning, adjusting, etc., thus making 130 full working days. Initial cost of vehicle, complete with tires, $2,880.

Wages: Driver, 26 weeks at $9.40	$218.40
Assistant, 26 weeks at $5.96	149.76
Gasoline: 5,200 miles (9 miles to gallon) at 18 cents	104.00
Oil and grease	24.00
Repairs, accessories, etc	96.00
Tires at 4 cents per mile	208.00
Registration	4.80
Insurance	48.00
Interest at five per cent on $2,880 for six months	72.00
Depreciation at 20 per cent on $2,880 for six months	288.00
Total	$1,212.96

Summary: Carries 1,560 tons; travels 5,200 miles; cost per mile, 23 cents.

It will be noticed that the cost of gasoline is 50 per cent higher abroad than in this country. Wages, however, are 50 per cent lower.

A 45-hp. motor ambulance has been purchased for the city of Harrisburg, Pa. Three policemen will be trained to operate it.

Two motor buses are operating between Watertown and Smithville, Tenn., via Alexandria. Ninety minutes is consumed in traveling between terminal points.

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Guaranteeing Maintenance Costs

Methods employed by an Indianapolis concern which maintains the machines it sells

WITHIN the past two years the Indianapolis Motor Car Company has succeeded in selling about 75 motor wagons of various ratings throughout the state of Indiana, chiefly on account of its businesslike procedure in executing contracts for maintenance with its customers at rates which vary from $15 to $50 per month according to the size and service of the machine sold.

The company's method of transacting business is to approach a prospective customer and request permission to care for all or a large part of the transportation of the establishment for a period varying from three to six days. Necessarily such a proposal requires a rather extensive stock of demonstrating machines. Throughout the demonstrating period the company receives pay for the use of its machines, the rate for service being proportioned to the ratings of the vehicles. The object of securing an abandonment of horse drawn service is quite obvious. Whatever conclusions are reached concerning the economy of the motor wagon are based upon an entire supersession of the draft animals. The whole stable, and not a ridiculously small part of it, is temporarily converted, enabling the owner to observe how many and how curious are the advantages to be gained therefrom.

* * *

The commercial need for the motor wagon is well exemplified in the large number of maintenance contracts which the company is carrying. Fifty of the seventy-five machines which the firm has sold are being cared for by it. This is equivalent to saying that the service of the motor wagon is at a premium.

The form of contract drawn between the Indianapolis Motor Car Company and its customers is as follows:

This agreement, made and entered into by and between the Indianapolis Motor Car Co., of Indianapolis, Ind., referred to herein as party of the first part, and ..... of Indianapolis, Ind., hereinafter referred to as party of the second part.

Witnesseth: The party of the first part hereby agrees to permit the following described car—owned by the party of the second part—to be placed in the garage of the Indianapolis Motor Car Co. and permits said car to be taken in or out of said garage by the owner or authorized agent as often as desired.

Description of car: Model ..... Number ..... Capacity ..... Manufactured by ..... Entered service .....

The party of the first part agrees to keep said car cleaned and rubbed, to keep all machinery in proper adjustment and ready for service, keep tanks filled and all parts oiled, providing car is placed in garage of said company every night.

The party of the second part hereby agrees to make no mechanical adjustments, nor to allow his driver to make any whatever, and in case car is not in perfect working condition at any time during deliveries, same is to be reported to the office of the Indianapolis Motor Car Co., upon receipt of which notice there will be an emergency car despatched at once, same to continue deliveries until such time as defective car is again ready for service.

The party of the first part agrees to furnish emergency car free of charge, unless owner's car is thrown out of commission, caused by accident over which the party of the first part has no control, at which time emergency car will be charged for at the rate of 50 cents per hour.

The foregoing clause relative to emergency cars applies only to cars working within a radius of 5 miles from the circle monument—Soldiers' and Sailors' monument in center of city.

The party of the first part furthermore agrees to keep up all repairs caused by poor workmanship and defective materials except tires, which are guaranteed by the maker, as long as said car is placed in said garage according to the terms of this contract.

It is herein understood and agreed that the party of the first part is not held liable for loss of car by fire, tornado or explosion.

In consideration of the foregoing, the party of the second part hereby agrees to pay the party of the first part the sum of ..... dollars per month, together with the cost of the gasoline and oil, the price of which will be 2½ cents per gallon over wholesale price for gasoline, and 10 per cent over and above wholesale market price for lubricating oil. All accounts payable first day of each month. Gasoline and oil must be receipted for by owner or driver of car.

Executed in duplicate this ..... day of ..... 190....

Signed ..... Owner.

Signed: Indianapolis Motor Car Co.

By .....

* * *

At the conclusion of each day's service the machines maintained by the company are carefully inspected and made ready for the next day's work. A card is placed on each vehicle containing the date of inspection, the number of the car, the names of owner and driver, the time of entering the garage, the names of washer and polisher, as well as the names of the persons who inspected the engine and transmission and the chassis and body. Supplies of fuel and lubricant are measured out in the presence of the driver, who signs duplicate receipts for them. One of these receipts is permanently retained among the records of the maintenance company and the other is mailed to the owner of the machine at the end of the month.

The service of the maintenance company's emergency car is of very considerable importance. It minimizes interruptions to traffic. One spare machine is allotted to every ten service vehicles. This proportion is probably rather higher than would be the case if the maintenance company were operating the machines of its customers and had control of their drivers.

Pittsfield and Nebo, Ill., are to be connected by motor bus.

Omaha is now provided with motor cab service.

Street lamps with colored globes and multi-colored columns indicate the stopping places for Paris motor buses. Fixed stopping places tend to reduce maintenance costs.

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CHICAGO'S MOTOR HEARSE.

THE motor hearse has found its place in Chicago. It is a steam driven machine owned by F. F. Roberts, an undertaker who strongly advocates the employment of none but motor vehicles for funeral processions to the remote cemeteries of the city.

The charge made for the use of the motor hearse to a distant burial ground is $75, that for a horse-drawn hearse being $50. Many of the local cemeteries are situated over ten miles from the heart of the city. Some are outside of the municipal limits. The selection of steam as a motive power for this hearse is partly accounted for by the disinclination of some cemetery authorities to admit the noisier gasoline vehicles within the premises under their jurisdiction.

MOTOR STREET SWEEPER.

THE motor driven street sweeper being tested in New York is fitted with brushes which dislodge the dirt and enable a series of receptacles, somewhat resembling the sections of a moving stairway, to discharge it into the body of the vehicle. The machine accomplishes its work with considerable rapidity. It travels at a speed of 15 miles an hour. The brush is placed in front of the machine.

The engine of a gasoline motor bus employed in service between Waynesfield and Wapakoneta, Ohio, exploded recently, only the front wheels escaping destruction.

The authorities of Akron, Ohio, have decided to purchase a motor hose and chemical wagon.

REFRIGERATING MOTOR MEAT WAGONS.

SEVEN refrigerating motor wagons have been purchased by the Mexican National Packing Company, of Mexico City. Each of these vehicles is 19 feet in length and weighs a little more than 4 tons. Each is equipped with a four cylinder, 30 hp. engine. The walls of the body are four inches thick and filled with materials which do not conduct heat. The capacity of each wagon is 12 carcases of beef. During the period of delivery the temperature of the interior of the wagon is never more than 47 degrees. These machines have been imported from England. Seven drivers were also sent across the ocean in order to insure good management and low operating cost. The installation is in charge of a superintendent, also imported. A garage is being constructed at the cold storage warehouse in Rancho Del Chopo.

PITTSBURG'S POLICE AMBULANCE.

PITTSBURG has purchased a police ambulance built by the Thomas B. Jeffrey Company. The machine cost $2,800. It can also be used for patrol service, in which capacity it will seat eleven policemen. The sale carries with it a guarantee to keep the machine in repair for the period of a year, no matter how severe the usage may be. This guarantee applies to tires as well as mechanism.

The Saratoga Taxicab Company, of Saratoga Springs, N. Y., has been organized with capital of $3,000.

Several motor coal wagons in Berlin are equipped with bodies which are tipped and emptied by mechanism actuated by the engine.

Steam Driven Motor Hearse Used in Chicago.

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EXTENSIVE ELECTRIC WAGON SERVICE.

FOR six years past R. H. Macey & Company, proprietors of a large department store in New York City, have been using electric delivery wagons with very considerable success. The firm now operates thirty such machines rated at one ton. Many of these machines have been remodeled, their weight at first being 5,600 pounds, but scaling at present 3,700 pounds. Each vehicle covers about 40 miles daily on a single battery charge. Batteries are charged during the night in the firm's garage, which is well equipped and quite extensive.

All the drivers of the electric wagons were formerly horse drivers. They are not permitted to have anything to do with the administration of the machines, their duties being strictly confined to steering the vehicles. In case of a breakdown the driver is expected to report by telephone to the garage, when the company's emergency wagon is rushed to the scene and expert repair men remedy the trouble which has arisen, or else the disabled vehicle is towed to the barn and there carefully examined and repaired.

The company's chief engineer, who has charge of the machines, aims to keep the entire fleet in service every working day throughout the year, and owing to the high administrative methods practiced it is seldom that a wagon is in such a condition as to be reported unfit for duty.

North Birmingham, Ala, has been supplied with a motor hose and chemical wagon.

A company is being formed to operate motor buses in Ilion, N. Y.

This summer five electric wagons will replace all the horse-drawn vehicles used by the Adams Express Company in Evansville, Ind.

A motor wagon will soon be commissioned for postal service in Lexington, Mass.

The board of public safety at Springfield, Ohio, has purchased a motor hose and chemical wagon at a cost of $7,190.

Motor cabs are to be operated in Oklahoma City by a company having capital stock of $10,000.

MACHINE FOR MILITARY SERVICE.

WITHIN a short time the Northwestern Military Academy, of Highland Park, Ill., will be provided with a 30 hp. machine fitted with an automatic rapid fire gun. The armament will be mounted back of the engine hood and over the dash, so as to be operated by the man who sits alongside of the driver. Provision will also be made for carrying ammunition and men in the rear. Commandant Davidson of the military academy says that machines of this character are admirably suited for coast defense and the quelling of riots. Some time during the summer this one will be driven to Washington, D. C., and its advantages demonstrated to the army authorities. Other motor vehicle equipment of the military academy consists of two steamers equipped with rapid fire guns and built in the academy's shops, and a gasoline vehicle fitted with searchlight for signaling.

Motor bus service is to be provided between Ashland and Odanah, the seat of the Indian reservation in Northern Wisconsin.

Mail and passengers will be carried in motor buses operating between Brady and Menardville, Tex.

The committee on mercantile affairs of the Massachusetts legislature has reported favorably upon a bill that aims to place motor cab fare and distance recording instruments under the jurisdiction of the state department of weights and measures. If the measure becomes a law taximeters will be attached to front axles. Furthermore, the instruments will be tested before they are certified as sufficiently accurate for public service.

The Iron County Transit Company has been organized to operate motor buses between Iron River, Paletka and Crystal Falls, Mich. The company has a capital of $10,000.

Paris has a motor wagon for the conveyance of stray or unlicensed dogs to the pound. It is fitted with seven basket cages of various sizes arranged in two rows.

It is expected that motor buses will soon be operating over the fine pike road connecting Frederick and Emmitsburg, Md.

Procession of Motor Funeral Vehicles Recently Witnessed in Chicago.

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Tariff Act Amendments

Senate finance committee proposes heavy increase in duty on imported automobile parts

COMMERCIAL motor vehicle makers who use foreign materials in the construction of their product will be interested in the amendments which the senate finance committee has made to the Payne tariff bill. Paragraph 140 of the Payne measure, which read "automobiles and motorcycles, and parts thereof, 45 per centum ad valorem," now reads as follows: "Automobiles, motorcycles, and parts of any of the foregoing, including tires, axles and ball-bearings, 45 per centum ad valorem."

In all probability this amended paragraph, if enacted, would be interpreted by the customs officials to mean that all and any parts whatsoever of an automobile should pay a duty of 45 per cent of their market value abroad, whether or not there were in the tariff act provisions which would otherwise designate lower duties for parts of automobiles. This has always been the principle proceeded on by the government where a special classification is made, taking the higher duty.

* * *

It is probable that in this situation the already large amount of litigation between importers and the government would be greatly increased. For example, there appears to be some doubt whether an unfinished forging or casting should pay duty as an automobile part, or as a forging or casting per se. Section 127 of the present Dingley tariff law imposes upon forgings of iron or steel, of whatever shape or of whatever degree or stage of manufacture, a duty of 35 per cent ad valorem. Section 121 of the pending tariff bill, which is proposed to supersede the last mentioned section, imposes a duty of 30 per cent ad valorem on forgings when, and only when, not machined, tooled, or otherwise advanced in condition by any process or operation subsequent to the forging process.

Paragraph 148 of the present Dingley tariff law, referring to castings, reads: "Castings of iron not specially provided for in this act, eight-tenths of one cent per pound." Paragraph 146 of the proposed tariff law reads: "Castings of cast iron, valued at not more than two cents per pound, one-half of one cent per pound; valued at more than two cents per pound, 35 per cent ad valorem. All castings of iron which have been chiseled, drilled, machined, or otherwise advanced in condition by processes or operations subsequent to the casting process, but not made up into articles, shall pay two-tenths of one cent per pound more than the rate imposed on the castings of iron hereinbefore provided for."

* * *

Let us take gas engine cylinders as an illustration. Assuming the cast iron cylinders of an ordinary four cylinder engine, weighing 250 pounds, cost 10 cents per pound, the duty under the present Dingley tariff law is, at eight-tenths of one cent per pound, $2. Under the proposed law these cylinders would, if classified as castings (valued at more than two cents per pound), be assessed, the foreign market value remaining the same, $8.75. The rate of duty under this classification of the current act being 35 per cent ad valorem.

The duty on purely unfinished forgings is reduced, in the senate amendments, five per cent. But the duty on any forgings upon which any work at all, in addition to the mere forging, has been done, is increased ten per cent. Fully finished forgings are assessed, as automobile parts, 45 per cent ad valorem.

That is, the policy of protecting American labor, insofar as the finishing work on forgings and castings is concerned, has been adhered to.

MOTOR GOSPEL WAGON.

EVIDENTLY the success of the railroad gospel car suggested the employment of the motor gospel wagon. The Rapid company is building a machine of the latter kind. Its big platform will be enclosed with a railing. The pulpit will be located in the rear, and in front of it will be a small organ and seats for the choir. The machine will be put in charge of an evangelist preaching in large cities.

The capital stock of the Cleveland (O.) Taxicab Company has been increased from $25,000 to $150,000.

A company has been formed to operate motor cabs at Taunton, Mass.

A movement is on foot for the construction of a first-class highway from New Orleans to San Antonio, Tex., a distance of about 1,200 miles.

ADDITION TO RANKS OF MANUFACTURERS.

FOR some time past the Brodesser Elevator Company, of Milwaukee, has been testing a light gasoline delivery wagon made in its shops. As a result of the experience acquired from the use of this machine the Milwaukee Motor Truck Company has been formed with capital stock of $200,000. The vehicle is equipped with an 18 hp., air-cooled motor. At present it is the intention of the company to confine its production to this model. Later, however, 2, 3 and 6-ton machines will be made.

The fire commissioners of Hoboken, N. J., have decided to recommend the purchase of a 70 hp. machine which will carry a crew of seven men and throw 700 gallons of water per minute. The cost of the vehicle will be $8,000.

Motor cab service will soon be established in Macon, Ga.

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The Electric Commercial Vehicle

Text of address read at the first annual convention of the Pacific Coast Electric Vehicle Association

BY A. C. DOWNING

TRANSPORTATION of merchandise is an expensive part of a business, especially in large cities where there is congested traffic and high labor. A solution will be the self-propelled vehicle occupying less room in the streets, getting away from railroad sheds and docks in better time, and one driver being able to move two tons in the same time necessary to move one ton with horses.

Street conditions play an important part in the successful operation of motor trucks. Hence the more rapidly streets are improved the quicker the machines will come into general use.

When approaching firms which are considering the use of commercial motor vehicles I find the owners, or managers, are always willing to give the matter due consideration. The superintendent of the delivery system and stable "boss" are called in to give such data as may be desired. They gladly enter into the spirit of the matter, appreciating fully the value of an up-to-date delivery system. Arrangements are made for demonstrations over the various routes, and then comes the real struggle. All the drivers imagine their jobs are in jeopardy. The horses have become part of their lives; hence arise jealousies and skeptical opinions. Many of them are "kill joys" of the first water.

* * *

One morning when demonstrating in Portland, Ore., I was waiting in front of a residence on Wilamette Heights when, presumably, the owner of the home and his wife came out to take a street car. In passing the wife said: "That is one of those electrics. I do hope they will become more general in service, as I hate to see the poor horses tire themselves out climbing these hills." Her husband, with stern voice, remarked: "They are all right on the level, but they won't last long on the hills," and with that stepped up closer to the machine and asked what experience I had had in negotiating the local hills. I replied the machine had been doing excellent work over Williamette and Portland Heights, obtaining exceedingly good mileage. Just at that moment the car came along. I have been looking for that man ever since to tell him that it did not require any power when going down grade, also that by climbing hills on intermediate speed the current consumption was some less than on high, thus gaining an efficient discharge from the battery.

* * *

Generally speaking this is a world of limitation. Every day produces more specialties, each object having its own function to perform. The doctor actively engaged in his profession cannot practice law, the brewmaster cannot sell ribbons, the gas maker cannot produce chocolate creams, the watchmaker cannot install a 5,000 h. p. turbine and generator, hack saws won't do for the production of a masterpiece oil painting, a ferry boat cannot compete with the Lusitania on the seas. So it is with the self-propelled vehicle against the horse-drawn type; both have their limitations and adaptabilities to their particular type of service.

Conditions must be considered. In negotiating the mountain paths of South America how long would the large Percheron horse last as compared with their mountain burro? In Venice what chance would a team of horses have as compared to the gondola or what kind of a show would the little Jap with a jinrikisha have against the taxicab for service in New York City. Such comparisons have about as sensible a sound as have some of the arguments put up against the commercial vehicle.

Labor saving devices are sold only after the public has been educated. We can all remember our first visit to a store, one part equipped with a cash box carried on an overhead wire, and the other part where the poor saleslady was continually ruining her voice calling for "cash." Many other such comparisons can be made.

* * *

In one instance my patience was tried to the breaking point, as one of the delivery boys was talking so boisterously, and boastingly, against the machine. I called the manager of the delivery system and asked him to give me that boy's route the next day. He did and naturally the boy hunted all the bad places possible. In spite of them we covered the route in exactly half the time usually consumed with his horses, and as a consequence the young man had to make another trip the same morning. Afterwards when the automobile delivery wagon drove up he was the first around and more than interested in how everything was going. He called me to one side saying, "I wish you would speak to the boss about me if they buy any of these machines, as I would like to drive one." This story is an illustration of what obstacles have to be overcome.

* * *

Electric trucks have been successfully operated longer than any other type. At present there are many machines five and six years old giving as good service as when first installed. The Weidemann Brewing Company of Cincinnati, which is a very hilly city, have six electric machines that have been in operation since 1903. To-day they are giving the same service as when new. The Anheuser-Busch Brewing Association have had fifteen of the three and five-ton capacity electric trucks in operation since 1903. The depreciation on them has been very small. At present their commercial department consists of fifty-six electric trucks, varying from one and one-half tons to five tons capacity, and four machines of the gasoline type for long runs. The Adams Express Company are using electrically propelled vehicles exclusively in Washington, Indianapolis and New Haven. They are using partial equipment in New York City, Chicago, Philadelphia and Rochester. The American Express Company are also using them in most of the largest eastern cities. The Los Angeles and Redondo Electric Railway Company are op-

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erating fifteen electric trucks in Los Angeles. These latter vehicles represent practically all the heavy commercial vehicles used in any quantity by one concern on the Pacific coast.

* * *

There have been failures with electric vehicles chiefly owing to the lack of proper attention, and intelligent application, trucks not being properly applied, and men in charge and operators not having had sufficient instructions as to care and operation from the makers. Often a five-ton truck has been sold where the load occasionally amounted to that much. The three-ton vehicle would have worked more successfully, making better time and entailing a smaller investment, and a much less cost of upkeep. Manufacturers in many instances have been responsible for such failures and mistakes. In several instances on the coast the vehicles were sold, money paid, the representative left for the east immediately, and all responsibility was shifted. Such practices have discredited the business, making it hard for a firm with good intentions to live it down.

Another tributary feature to failure has been a mistaken idea many have had regarding giving automobiles attention. No piece of machinery is called upon to do so much work, with no little attention, as the automobile. This has been particularly true with commercial vehicles. I have known personally, in three instances, of a motor truck running for five months without the wheel bearings even looked at. Would anyone treat a horse-drawn wagon in that way? The best part of it was the bearings were not injured; thus clearly demonstrating the life a self-propelled vehicle would have if given proper attention.

* * *

For long distance or interurban work the gasoline machine is most suitable. For city and suburban purposes the electric will prove more economical and satisfactory. Following are a number of reasons for my making this last statement:

First. Their speed is within the scope of the law and the bounds of safety. A loaded car propelled at too high rate of speed is a menace to public safety.

Second. If heavy loads are carried at greater speed than seven to twelve miles per hour, over the ordinary street one finds in the wholesale and shipping districts of a city, the strain and shocks on the wearing parts will cause more cost of upkeep than will be saved by quicker delivery. Engineers' tests have often proven this.

Third. Being free from so many small mechanical moving parts insures reliability.

Fourth. Simplicity of control permits an electric truck being handled successfully by regular horse drivers.

Fifth. The motors employed are of the series type, like those of the street car. They are built to stand extreme overloads for an instant. Most everyone knows electric motors have long life, entailing very small cost of upkeep.

Sixth. The storage battery in its present stage of development represents a certain number of cycles (that is charges and discharges), thus making it possible to figure, with a degree of accuracy, the number of miles obtainable during the life of the plates. With this data at hand the cost of operation can be easily determined.

Seventh. Continuous torque controllers eliminate all chances for arcing and "freezing." It is very seldom any trouble arises from the controller outside of the ordinary wear and tear.

Eighth. Batteries and motors being hung underneath the framework, permits any body design desired. Also permits equal distribution of load over the rear and front wheels.

Ninth. This equal distribution of weight saves tire expense, particularly on the rear wheels, where the tires have to withstand the tractive friction as well as the weight of the load.

Tenth. Accessibility to all parts means simplicity in repairing and garage care. With an electric truck, the controller is independent mechanically of any other part. By loosening the wire terminals it can be removed and another replaced easily within an hour. In five years' association with electric commercial vehicles I have never found it necessary to pull out a controller provided the machines have had any kind of treatment whatsoever. Batteries can be exchanged by two men in fifteen minutes. Should an armature need attention, or should it become necessary to replace the motor complete, the change can be made within an hour and a half. Of course the repairing of axle, bearings, frame, body, or wheel, would remain constant with either gasoline or electric vehicles. Summing up this tenth item means that an equipment of, say, ten gasoline machines would require two or three extra machines to keep up the daily service, while one extra will do for an equipment of thirty electric machines. This point is not a guess or theory, but a statement of results after quite a few years of actual work with machines in various classes of service in widely different cities.

Eleventh. The keeping of electric machines in any building does not affect insurance.

Twelfth. When caring for electric trucks little high-grade help is necessary. One experienced battery and motor man can successfully handle several trucks. If additional help is desired most anyone can wash, clean and reburn batteries, with very little experience. The motors and electrical parts have never caused enough work, in installations even the size of Anheuser-Busch, to keep one electrician busy all the time.

COURT AWARD FOR DAMAGE BY COLLISION.

A YEAR ago last fall a motor truck owned by Patrick F. Green, of Glen Cove, N. Y., was struck and completely destroyed by a locomotive owned by the Long Island Railroad Company. Green instituted suit for damages and secured a verdict for $2,800. The case was appealed by the company and again Green won, the second jury awarding him $2,900. He sued for $3,500.

Plans are being matured to provide motor cab service for Toledo.

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AN ECONOMICAL AMBULANCE.

DURING the first quarter of the present year the steam driven ambulance owned by the city of Chicago responded to 705 calls and covered 7,654 miles. The daily average was about 85 miles, the most active day's work totaling 181 miles. For the corresponding period of 1908, during which four horse-drawn ambulances were employed, 504 calls were answered and 6,728 miles were traveled.

This rough comparison of work performed by each type of vehicle is more than enough to establish the value of the machine in such service. The physician in charge of the machine, which, as stated in the last issue of this journal, is exclusively employed in transporting patients suffering from contagious diseases, declares that its economy is fully as great as its usefulness. Since November 1, 1908, it has covered almost 12,000 miles.

MOTOR WAGONS NOT WANTED.

THE project to replace the mail carrying trolley cars of the Brooklyn Rapid Transit Company with motor wagons has been abandoned. The company's contract with the government expires in June. There was a dispute between the government and the company over its renewal, owing to the demand of the latter for an increase in the 15 cents a car mile rate, and an automobile company made a bid for the job.

The Auto-Funeral Car Company has been organized in Cleveland, Ohio, with capital stock of $150,000.

The Pennsylvania Railroad Company recently asked for bids on the construction of 120 all steel rail motor cars. It is expected they will cost $2,000,000. They will be used in running through the Pennsylvania tunnel under the East river at New York.

MOTOR TRUCKING IN THE FAR WEST.

HORSE transportation between Los Angeles and San Pedro affords a profit despite the unimproved condition of the roadway connecting the two cities, which are 20 miles apart. Hence it is believed that motor trucking between the two points would, when the projected macadamized boulevard is built, prove economical and of great commercial advantage.

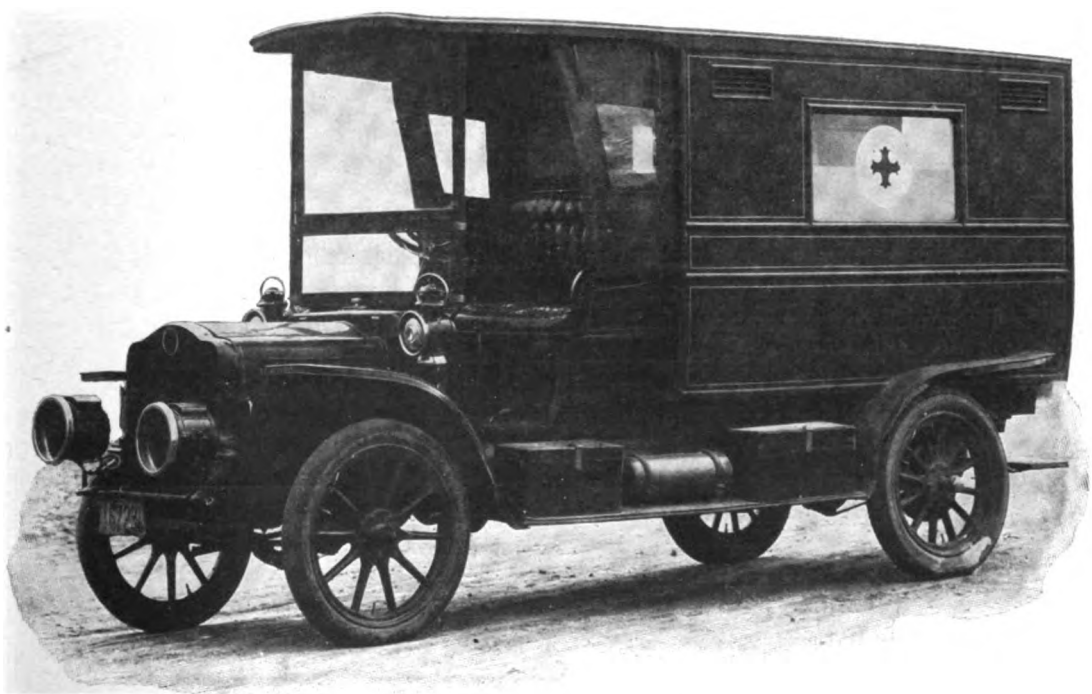
Strong efforts are being made to consolidate the commercial interests of the two Southern California cities, and the project to establish a motor truck line is meeting with very considerable encouragement. It is also planned to establish a publicly owned deep water wharf where vessels of heavy tonnage may be moored and from which their merchandise may be transported by means of fast moving road vehicles. The state legislature has appropriated $18,000,000 for the improvement of the local roadways, a large share of which will be spent in the county of which Los Angeles is the principal city.

Rail freight rates are excessively high between Los Angeles and San Pedro.

YELLOWSTONE PARK MOTOR TRAFFIC.

FREIGHT and passengers will be carried by motor vehicles between Rock Springs, Wyo., and Yellowstone park via Green river. The service will tap the heart of a country rich in scenic beauty and unusually well provided with game of all kinds. The Wyoming Auto Transit Company will conduct the enterprise. It is already at work bridging gulches and improving the roadway. Well appointed garages will be located at convenient points on the route.

The Denver Omnibus and Cab Company, which operates a number of commercial motor vehicles, is about to erect a garage which will cost $150,000.



Steam Driven Ambulance Owned by the City of Chicago Which Averages 85 Miles a Day.

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Elimination of Gear Noise

Accuracy in cutting, finishing and mounting of gears necessary to produce a quiet running vehicle

NOISE from gears is one of the most important things to consider in the making of a quiet-running automobile. A transmission can now be made of hard alloy steel with practically noiseless spur gears so far as vibration is concerned. Experience in electric machines long ago indicated that an unhardened gear of the herring-bone type could be made positively noiseless. Of course a sliding herring-bone gear cannot be made.

One theory of noise in gears is that of irregular tooth pressure, when, from slight inaccuracy, one tooth has a pressure different from that of the next succeeding tooth, thereby setting up a varying vibration and backlash. If the speed of the gears is rapid, a complicated vibration, amounting to a noise, is set up. The shape of the transmission (change speed gear) case has a material effect on its quiet running qualities.

In one method of cutting gears the teeth are planned, not cutting too much, making every effort to get the gears accurate. In another method the cutting is done by a rotary cutter, accuracy being obtained by making a large diagram of the shape of the cutter, making it sometimes ten times the normal size and then forming the cutter accurately to suit the number of teeth and pitch in each particular gear. This makes a more difficult job to get an accurately generated tooth-shape, and great accuracy between each tooth, than with the planing process above mentioned. It is difficult to overcome the distortion of a gear in hardening.

In the case of camshaft gears there is an action different from that of any of the other gears in the car—an intermittent action. There is a diversity of opinion as to the proper size, width of face, pitch and material of camshaft gears, to best solve the problem of this particular condition.

* * *

Bevel gears, it is pretty generally conceded, run more quietly than spur gears. One reason given is that they have a chance to spring away from the tooth pressure, whereas the spur gears have not unless their shafts and bearings also spring away.

A high-grade gear, which may reasonably be expected to stand up to its work for tens of thousands of miles, must be properly designed, of the proper material. subjected to repeated approved heat and mechanical treatments, and be accurate not only as to tooth-form, but have a hole of true and proper size, its keyways, or corresponding members, of proper dimensions and accurately located; its blank having been turned true and of exactly proper diameter. To obtain quiet-running the form of the tooth must be laid out properly, selecting from the different forms advocated by various engineers; every step in its manufacture and mounting made carefully and with precision.

There is a difference of opinion as to whether relatively large or small gear teeth run more quietly; that is, teeth of large or small pitch. One argument in favor of the fine teeth as against the coarse is that they have a greater number of teeth, or points of contact, in mesh at one time, which distributes the load and prevents chatter.

* * *

Noise is due primarily to inaccuracy of tooth-form, but can also be caused by putting a pair of gears in mesh too closely. With a "hunting tooth" arrangement, that is, with an odd tooth in one gear (the number of teeth in one gear not being a multiple of the number of teeth in its mate) the gears may wear to a state of comparative noiselessness after a while. However, good gears will not show material wear in a reasonable length of time. Running in emery and oil for a time in assembly or test will reduce noisiness somewhat, but unless the teeth are properly and accurately formed in the first instance this will seldom obviate the trouble entirely. Assuming that the gears are set with a proper amount of clearance between them, running in emery will help very little.

To determine whether a web gear, as distingushed from a spoked one, will in a certain position cause noise is a question largely of experiment. All possible chances of side strains should be considered and provided for. If there is any chance of the shaft, carrying the gears, being thrown out of alignment, there would be a slight throw of the web, which would cause noise, as it would be in the nature of a vibration.

* * *

In regard to material, the metals that run most quietly together are bronze and steel. Of course, fiber, fibroid, rawhide and composite materials give very good results where the load is not heavy.

Machining gear teeth so as to make them perfectly noiseless is expensive, but it is possible. They may be surprisingly loose and yet quiet. Any gears that have the correct form of tooth will run together quietly, loose or tight, providing they are not too tight, say with a backlash of one or two-thousandths of an inch. The points of a spur gear have a theoretical tendency to interfere. If this were not so, the spur gear would be practically as quiet as the herring-bone type of gear. It is impossible to illustrate exactly the action of the herring-bone gear, but, in an exaggerated way, it is analogous to the action of a worm meshing with a worm wheel.

The question of noise in gears comes down to a question of accuracy, not only in cutting and finishing, but in mounting them in their respective places. The shafts on which they are to run must be parallel and be in the same plane.

Traverse City, Mich., is to be provided with motor buses in lieu of street car service. A company with capital stock of $20,000 is to be formed, and operations are to commence this summer.

Efforts are being made to establish motor cab service in Lawrence, Mass.

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MOTOR GARBAGE WAGONS.

THE economy of municipal motor wagons of all kinds is so well and so long established that one cannot help expressing surprise at the slowness with which they are being provided in rich and populous cities. In Detroit, however, the authorities realize the great waste of public money which results from the employment of horses in removing house garbage and street refuse, and they hint at the employment of power wagons.

When the present service was instituted animals could be bought for $80 or $100. The other day two were bought for $300 apiece. This increase in the cost of equipment, unattended by any corresponding advantage in the way of efficiency, irritates the superintendent of streets, who says:

"We have to get good horses to do this work. I do not know just what we will do if the price of horses continues to go up. Last year I figured on new horses at $250 each, but the council thought I had placed the amount too high, and cut it to $225 apiece. We cannot get the kind of horses we need for less than $300, however, and that means that we must purchase fewer horses than we had intended. Feed and bedding are also much higher in price than a few years ago, and the garbage division has a hard time to get along on its appropriations."

The moral is too obvious to require elaboration.

MOTOR ENERGY WITHOUT COST.

A MOTOR which costs nothing to operate once it is started is said to have been invented by G. W. Johnson, who owns an electric lighting plant at Grant City, Mo.

"My invention utilizes compressed air," says Mr. Johnson. "I call it an air and vacuum motor. After an initial charge it will run indefinitely and propel anything that may be moved. It has not been perfected to run stationary machinery and must gather energy as it goes. It will furnish any amount of power and is suitable for motor cars, airships, street cars, railroad trains, farm machinery and other things. I have tested it thoroughly—have adapted it to a motor cycle—and it is a success."

Trot it along, Mr. Johnson. An impatient public wishes to know how much it weighs, what it will cost, how liable it is to derangement, and how much superior it is to other compressed air motors which engineers have flung aside as impracticable.

The total cost of operating a 26-passenger horse-drawn bus in London is 16 cents per mile, based on 63 working miles per day. A modern 34-passenger gasoline motor bus, covering 120 miles a day, costs about 18 cents a mile to operate.

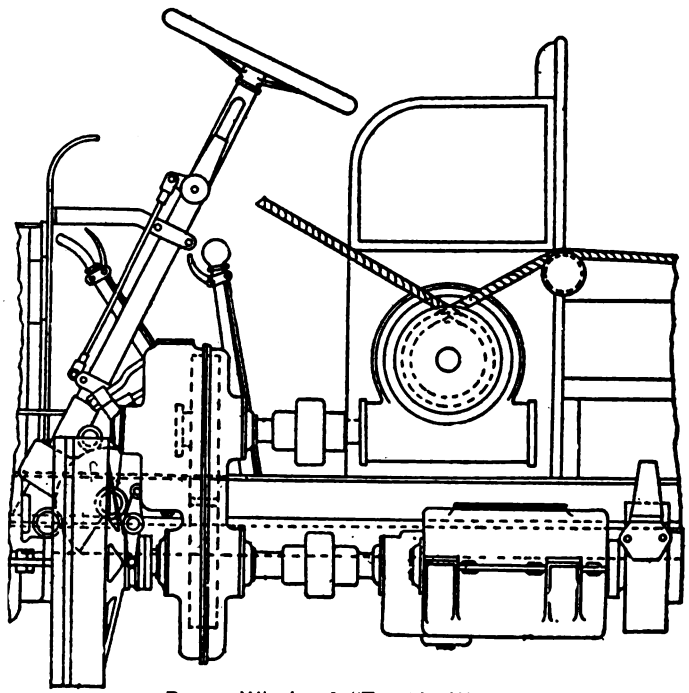
Seven large motor wagons have been installed in the Munich postal service.

The Taxi Motor Cab Company has been formed in Boston with capital stock of $375,000. The president of the company is A. W. Pope.

A USEFUL "TROUBLE WAGON."

WHEN a motor cab is disabled on the road it must either be towed or bodily transported to the barn for repair. The latter method is often necessary, and upon such occasions the "trouble wagon," fitted with winch drum and special means for loading, comes into play.

One of the big motor cab companies has a two-ton emergency wagon of this sort, from the rear of which a runway consisting of two broad rails may be extended.



Power Winch of "Trouble Wagon."

It is equipped with a power driven winch, the drum of which is placed under the driver's seat. The drum is actuated by the engine driving shaft and spur gears housed in a casing located back of the fly wheel. Motion is communicated from the transmission shaft to a special countershaft above it, the drum being driven by a worm. The winch drive is controlled by a special arrangement of the regular gear control and is brought into operation only when the shifting lever is in neutral position.

CUTTING RIVER ICE BY MOTOR.

A MOTOR driven sled, fitted with a circular saw in the rear, is used for cutting ice on the River Spree in Germany. The saw is placed inside of the framework. The power of an air-cooled motor is transmitted by means of protected belting. The propelling wheels, fitted with grippers, are located in front and within the frame. They are chain driven. The frame is mounted upon runners. The machine is steered from the front. The gripping wheels can be put out of contact with the ice by throwing a lever.

The Portland (Ore.) Taxicab Company has been formed with capital stock of $25,000.

The Industrial Automobile Company has been organized in Elkhart, Ind., with capital stock of $75,000.

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ELECTRIC CHARGING STATIONS IN NEW YORK.

MORE electric wagons are used in New York than in any other city in the world. The number cannot be much short of 1,300. Many of them require a little battery "boosting" in the course of a day's arduous work, and unless their owners or drivers happen to be familiar with the location of the stations at which current may be obtained serious interruption to traffic may occur.

The New York Transportation Company, realizing the necessity of rendering assistance of this character, has just printed and extensively distributed a map of the district showing the location of 40 stations where current for all kinds of electric vehicles may be procured. One of these stations, situated at 141 East 125th street, is a commercial vehicle garage. The others are either branch establishments of the public lighting company or plants owned by automobile dealers.

It is a curious fact that the number of electric pleasure vehicles in New York is not nearly so large as in Chicago, the representation in both cities being about as follows: Chicago, 3,000; New York, 1,000. But of commercial electric vehicles Chicago has barely 100. It is hard to account for the comparative scarcity of electric wagons and trucks in the western metropolis. Its streets are not so well paved or maintained as those of New York, but the economic employment of such vehicles is not barred on that account. Indeed in all instances where they are well administered and properly adapted they are affording a very superior service. It is quite likely that, in view of the intelligent co-operation of all the interests involved by the production of electric wagons, the sale and employment of such machines will be much facilitated in the future. The establishment of local public charging stations will greatly hasten the development.

WORK OF YEARS UNDONE.

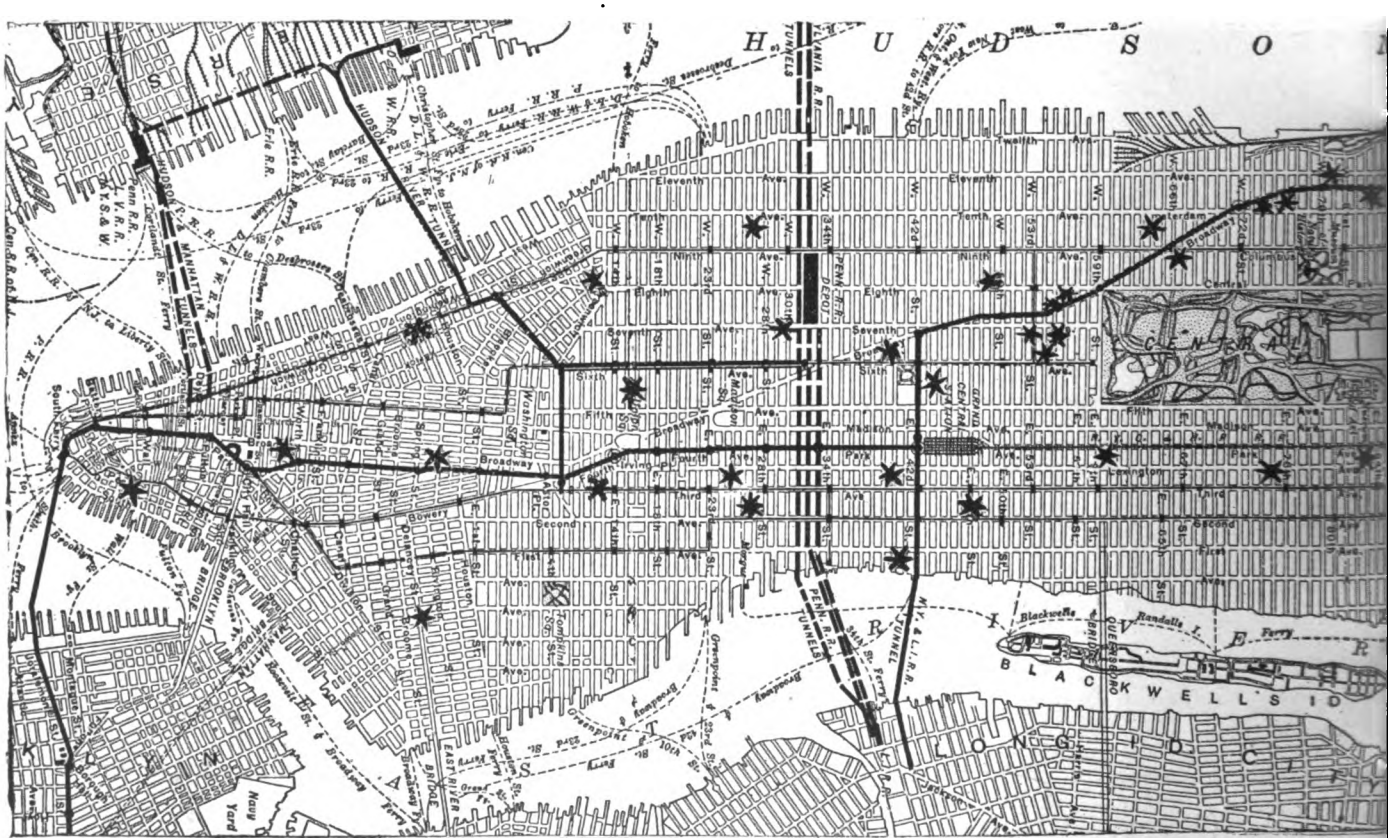
THE New York Fire Insurance Exchange recently notified the owners of ship docks that if gasoline or steam driven vehicles are permitted to have access to their piers the rate of insurance will be increased 50 per cent.

This decision, quite unexpected in the light of recent concessions by the dock owners, also affects vehicles driven by kerosene, benzine or naphtha. The local retail trade association, as well as the two big national manufacturing bodies, will fight for equal rights on dock piers for all motor vehicles. Failing in this the rate of insurance will be 50 cents for every $100 of liability.

The drivers employed by the Boston Taxi-Service Company are now working on salary. Formerly they were paid 20 per cent of vehicle earnings, and purchased their own fuel.

A motor road train, consisting of tractor and three trailers, is employed in hauling soda from the mine in the desert near Johannesburg, Calif., to the nearest railroad station, which is 26 miles distant.

The Cunningham Motor Express Company, of Hempstead, N. Y., has been organized to transact a general haulage business. Its capital stock is $3,500.



Map Showing Location of New York Transportation Company's Electric Vehicle Charging Stations in New

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MOTOR TRUCKS FOR THEATRICAL SCENERY.

THE expense of transporting actors and theatrical baggage from point to point on a circuit is very great. Many of the railroad companies whose roadway is used charge such exorbitant rates that the principal factors in the powerful theatrical syndicate, Klaw & Erlanger, have decided to use motor trucks and buses wherever their service is deemed practicable. Several large machines are now being built for this purpose.

In the central and eastern states the usual "jump" of a theatrical company is 75 miles. Every company of any size carries expert mechanics on its working staff, so should a machine encounter hard luck in transit it can be easily repaired. Throughout the New England states, where the movements from town to town vary from 10 to 30 miles, and the railroads charge a minimum of $15 for the hauling of a baggage car, the motor trucks will, with the saving of the daily transfer bill, pay for themselves inside of a short time. The transfer, by horses, of a theatrical company's scenery from railroad depots to playhouses occurs with such frequency as to be very destructive of the property transported. The number of handlings it receives in the course of a season could be much reduced by carrying the baggage direct from the stage door of one theater to that of another.

A company has been formed in Muncie, Ind., for the manufacture of motor driven street sweepers.

By June it is expected that 50 motor cabs will be operating in Seattle, Wash.,

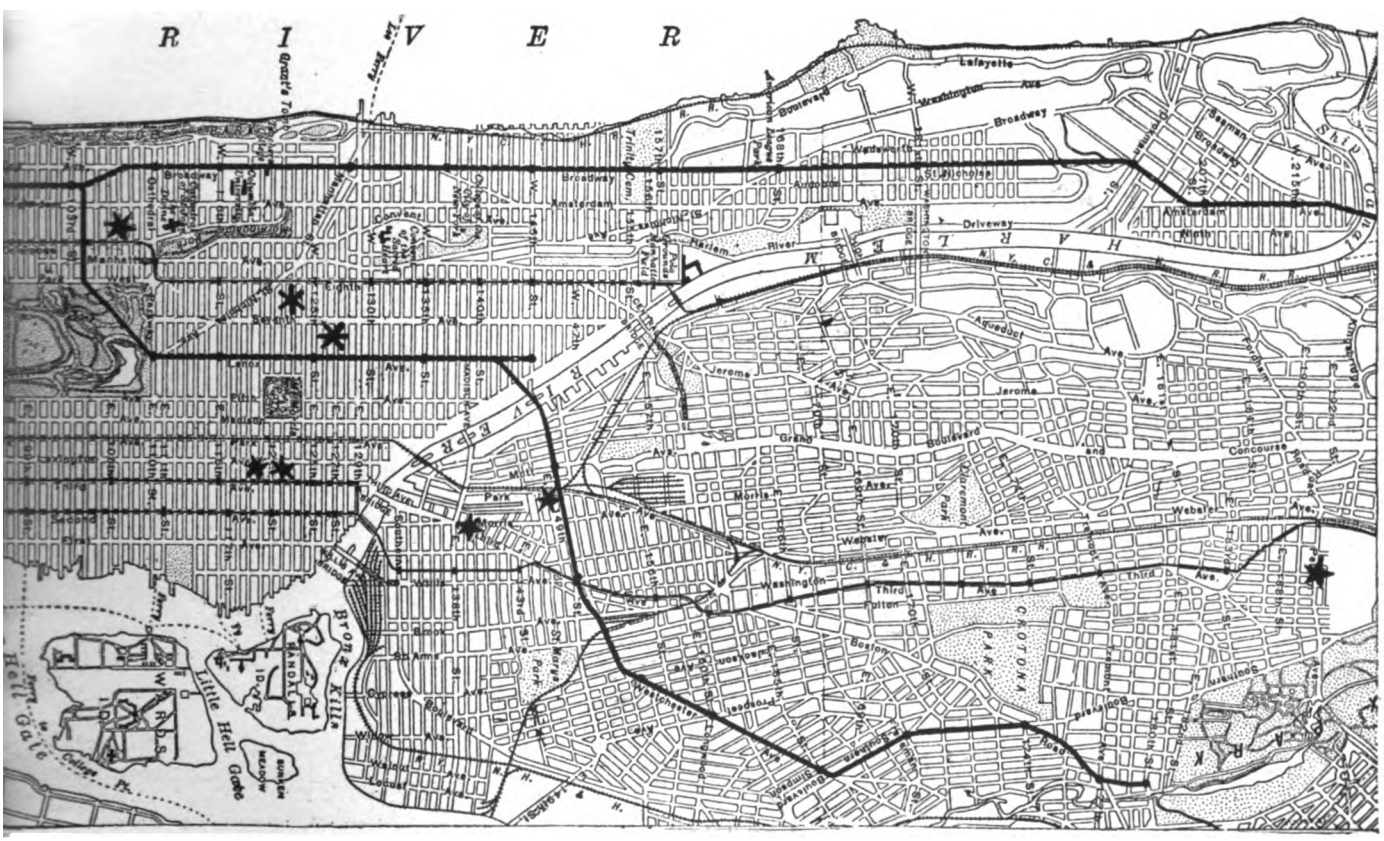
THE SCOPE FOR MILITARY WAGONS.

THE need for punctual delivery of food supplies, especially in winter, to garrisons stationed some distance from large cities has led to the employment of the refrigerator motor wagon in Germany. In commenting upon this service a well known military critic remarks:

"A very sensible measure, which urgently needs adoption elsewhere. Much more use must be made of the automobile in the German army than at present. Its application, in case of war, must also be considerably widened. Only with the help of small gauge field railways and self propelled vehicles will it be possible to ensure a commissariat for the enormous masses of troops. Consequently, should the train battalions to the regiments be enlarged, it would be desirable to furnish only one more battalion to two companies with horses, and, on the other hand, to equip a second battalion of likewise two companies with automobile trains. The second line, too, of the ammunition columns must be transformed by degrees into automobile troops. Only what must come in direct touch with the fighting lines should be horse drawn—and that only until the machine is equal to cross country traveling."

The Berger Taxicab Company, of Brooklyn, N. Y., has been formed with capital stock of $25,000.

Notwithstanding the opposition of the mayor, the city council of Alameda, Cal., has authorized the purchase of a motor hose and chemical wagon. The machine will cost $8,000.



The Stars Indicate the Location of Plants Where Current May Be Obtained. There Are Forty Such Stations.

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LOCOMOTIVE COMPANY'S THREE-TON TRUCK.

AFTER two years of experimentation the American Locomotive Company has placed its 3-ton gasoline truck on the market. The machine is equipped with a four cylinder vertical engine which develops 16 hp., at 800 revolutions per minute. The engine bore is 3 15-16 inches and the stroke 4¾ inches. Ignition is obtained by means of high tension magneto. The clutch is of the multiple disc type. The sliding gear transmission provides three forward speeds. The standard wheel base is 110 inches; the tread is 64½ inches in front and 66 inches in the rear. The tire equipment is 36 by 5 inches in front and 36 by 3½ inches, twins, in the rear. The frame is 41 inches wide. The length over all of the standard model is 182½ inches. The weight of the chassis is 4,500 pounds. Fuel tank capacity for 21 gallons is provided. Final drive is accomplished by means of side chains from a jack-shaft.

The slow engine speed at which the useful power of this machine is developed is in striking contrast to the high speed engines of many other vehicles of the same type and rating. Another conservative feature of design is the road speed of the truck. At 800 engine revolutions per minute the maximum rate of travel is 9 miles per hour, the intermediate speed giving 6 miles, and the slow speed 3 miles.

A company is being formed to operate six 20-passenger motor buses in and around Pen Mar park in Hagerstown, Md.

Mountain Home and Cotter, Ark., are to be connected by motor bus.

ELECTRIC INTERESTS CO-OPERATE.

FUSION of the common work purposes of electric vehicle makers, storage battery makers, and electric light and power companies has been formally effected by the organization of the Electric Vehicle and Central Station Association, membership in which is open to all who are engaged in the manufacture or distribution of electric vehicles, the sale of electric current or the appurtenances thereto.

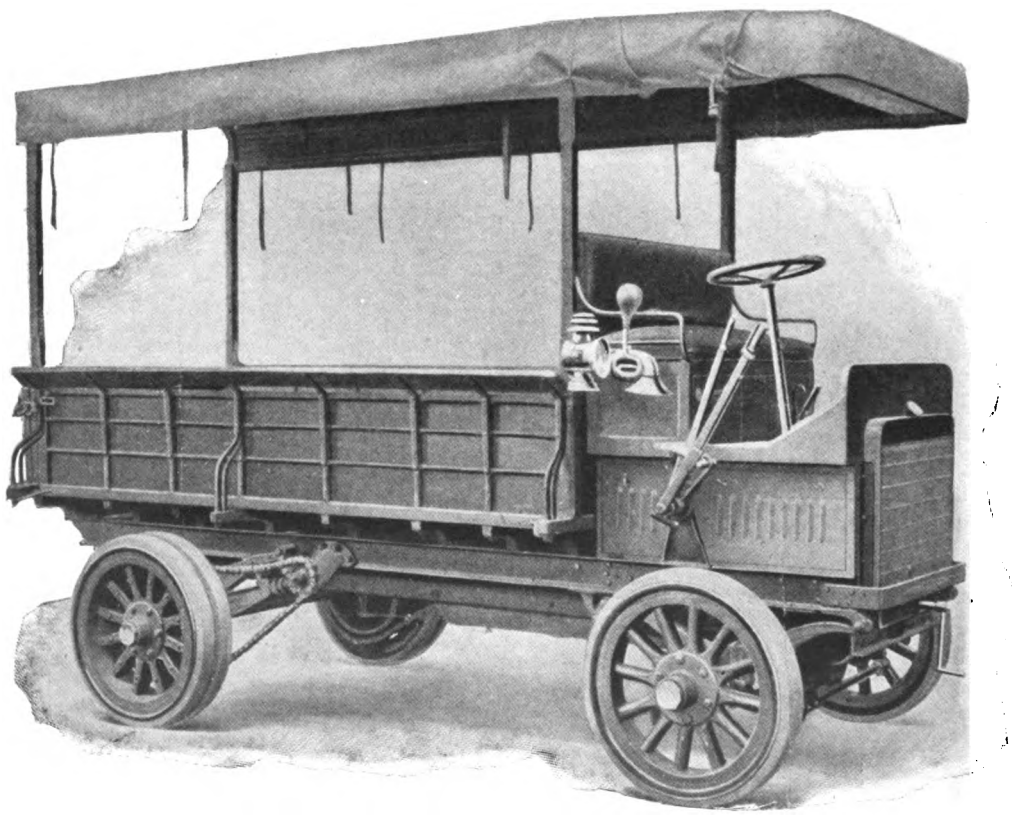
The following officers have been elected: President, Frank J. Stone, Electric Storage Battery Company, Boston; treasurer, L. R. Wallis, Edison Illuminating Co., Boston; secretary, H. T. Sands, Malden Electric Co., Malden, Mass.; executive board—E. W. M. Bailey, S. G. Thompson, A. C. Gray, A. F. Neale, Day Baker, N. T. Wilcox, D. E. Manson, J. H. Neal, and C. B. Davis.

At various advantageous points garages and charging stations will be established in order to extend the mileage of electric machines. This plan for the maintenance of relay charging stations is one which many years ago was discussed and approved by the electrical interests connected with the automobile industry.

CHAIN DRIVEN, NOT SHAFT DRIVEN.

LAST month in describing the seven-ton motor hose and chemical wagon supplied to the New York fire department by the Knox company it was inadvertently stated that the machine was shaft driven. Manifestly this was an egregious blunder, for, as is well known, all heavy vehicles of this type are driven by chains from a jack-shaft to rear wheels.

Six motor cabs are operating in Youngstown, Ohio.



American Locomotive Company's Three-ton Gasoline Truck.

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LIMITING HEIGHT OF MOTOR BUSES.

SEVERAL motor bus drivers have been arrested by the New York police in the effort to enforce the ordinance prohibiting vehicles more than ten feet high from traveling over Riverside drive. Eventually the contest between the operating company and the park commission will be decided by the supreme court.

"The ordinance under which these arrests were made," says President Meade of the Fifth Avenue Coach Company, "applies to all thoroughfares under the jurisdiction of the park commission, which includes the streets crossing Central park, Fifth avenue, Columbus circle, Jerome avenue, Washington square, and many others. Street cars are certainly more than ten feet high, yet street cars are operated on many of these thoroughfares.

"Like other parkways, Riverside drive is primarily for the people's benefit, to afford them a breathing place where the air is plentiful and healthful. The pretext that motor buses would injure the trees is superficial, and if it is upheld we may expect similar moves involving Washington square and Fifth avenue.

"Surprise has been expressed that we should have a franchise applying to streets under the jurisdiction of the park board, but no other form of transportation can be supplied. In London, Paris and Berlin buses are recognized as an indispensable facility for transportation, and they thread their ways through the parkways and no objection has ever been made.

"Not only is the present situation an exasperating one for the public, but it also causes us great loss, as it holds up our valuable equipment. The motor bus is a recent perfection and we have in contemplation an investment of at least $300,000 more in a short time."

A test case, it is said, is to be immediately made in order to determine the right of the park commission or the police to interfere with the operation of motor buses as at present constructed.

MORE CABS FOR PHILADELPHIA.

THE Taxi Service Company, which operates motor cabs in Boston and New York, has invaded Philadelphia. A large number of machines will soon be installed. The subsidiary company which will operate the Philadelphia machines is incorporated for $1,000,000, half 7 per cent preferred stock and the remainder common.

At present there are about eight motor cab companies in Philadelphia, each running from five to twenty machines, but on account of the limited number of stations and equipment of the concerns the dead mileage is very large. The new company expects to reduce this loss to a minimum through establishing many stations and operating a large number of cabs.

Jackson and Sacramento, Calif., are now connected by motor bus. The running time is four hours. The fare is $3, the same as charged by the railroad.

The twelve miles which separate Seymour from Brownstown, Ind., are now covered by motor bus.

ADDITION TO CHICAGO CAB OPERATORS.

DESPITE the fact that Chicago has never enjoyed reputation for the extent of its public road vehicle service, its motor cab traffic is beginning to assume proportions worthy of the second city in the country. Until very recently every local motor cab enterprise has seemed to be an experimental undertaking; that is to say, capital has not been available in such abundance as to provide enough machines to take care of the public demand for the vehicles. The half dozen operating companies are now straining to increase their equipment and prevent any single concern from acquiring a monopoly of the traffic.

The railroad depot traffic is still an asset of the horse cab companies. The clubs, hotels, large office buildings and restaurants, however, are almost exclusively served by machines, and the demand for their service is so active as to justify the opinion that even at this moment 1,000 could be employed without any particular risk to the capital invested.

As yet no liberally equipped company has been organized. The nearest approach to such a concern is the City Motor Cab Company, which has just been formed by John D. Towne, John Borden and Harold S. Wallace, and which has completed arrangements with the Ewing Automobile Company, of Geneva, Ohio, to accept delivery of its product as fast as it is possible for the factory to turn it out. The Ewing cab has capacity for four passengers, is fitted with a 20 hp., four cylinder, water-cooled engine; its wheel base is 106 inches; the tread is 54 inches; transmission is of the sliding gear variety. The vehicle is shaft driven and fitted with a disc clutch.

The City Motor Cab Company is erecting a model garage at the corner of Huron street and Fairbanks court. When finished it will be one of the most completely equipped institutions of its kind in the country. The company has been organized with capital stock of $50,000. Its principal stockholders, however, are very wealthy. The company's principal customers just now are members of the new University club.

MOTOR BUSES IN PITTSBURG.

MOTOR buses are now operating in the transfer of passengers from the Duquesne incline to the downtown district of Pittsburg. The machines, made by the Rapid company, carry 20 passengers, and run every four minutes during the rush hours and at eight-minute intervals during the remainder of the day. The incline company will lease ground and build a bus shed and station. According to the officials of the company the plan will develop into a money-making venture.

"The street railway company wanted four cents for every transfer," they say, "and this was entirely out of the question. At the old rate of two and one-half cents they made over $50 a day, and we can afford to run motor buses at that figure."

The authorities of Gary, Ind., have decided to purchase a motor police wagon and a motor hose and chemical wagon.

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MILLION DOLLAR CAB COMPANY FORMED.

WITHIN a month Henry Allen, formerly at the head of the New York Taxicab Company, expects to have completed arrangements for putting 1,000 more gasoline cabs on the streets of New York by September 1. He has formed the Allen-Kingston Taxicab Company with capital stock of $1,000,000, and announces that the machines can be hired at a much lower rate than that which now prevails. Several capitalists who formerly held stock in the company from which Mr. Allen withdrew are heavy holders of the new company's securities. The machines will be provided by the Bristol Engineering Company. The initial charge for service of the new machines will be 30 cents. Most of the large companies in New York are now pledged to obtain 50 cents for the first half mile. Mr. Allen will be president of the new company.

LOST $50,000 IN MOTOR CAB INVESTMENT.

THE filing of an application for a receiver for the American Taximeter Cab Company, of New York City, gave the investing public an opportunity to observe how easily it may be deceived by the representations of promoters.

It appears that the plaintiff, Richard C. Doggett, who made a fortune on the turf, bought $75,000 worth of stock in the concern from L. H. French, the vice-president and general manager, with the understanding that he was to get treasury stock. Instead, he alleges, most of the stock he received was transferred to him by French, who had taken it from the company without consideration. Doggett alleges manipulations by which most of the money went into the pockets of French. Doggett declares that the assets of the company consist of ten second-hand taxicabs and $375 in cash.

Outside of court Doggett says that he considered the proposition a good one, because French told him that among the board of directors were F. D. Underwood, president of the Erie railroad; Frank Merrall, of the Acker, Merrall & Condit Company, and Thomas H. McInnerney, one of the leading business men of Rochester. Doggett thought well of the venture until he saw a letter written by President Underwood declining to become a director of the company.

MOTOR CABS FOR INDIANAPOLIS.

A CONTROLING interest in the Frank Bird and Indianapolis Transfer companies has been purchased by John E. Morand, who proposes to replace all of the horse-drawn vehicles of these two concerns with machines. Ten motor cabs will be installed as a beginning.

The two St. Louis branches of the Firestone Tire & Rubber Company have been consolidated in the enlarged store at 2230 Oliver street. O. O. Petty is manager of the consolidated branch stores.

A general haulage business is being conducted by the W. & R. Motor Truck Company in Taunton, Mass. The company has a capital of $50,000.

MOTOR CAB FARES INCREASED.

EARLY in April the New York Taxicab Company increased its tariff, fixing the initial charge at 50 cents instead of 30 cents, and making the waiting charge $1.50 an hour instead of $1. A sending charge of 20 cents a mile has been established for all calls north of 156th street or outside of Manhattan. A return charge of 20 cents a mile is also made from points north of 156th street. For each piece of baggage the charge is 20 cents.

About the middle of the month the New York Transportation Company decided to make 50 cents the initial charge for its electric hansoms, with 10 cents for each half-mile thereafter, and a waiting charge of 10 cents for every six minutes. Electric and gasoline landaulet charges will be 50 cents for the first half-mile, 10 cents for each additional quarter-mile, and 10 cents for every four-minute wait.

Neither of the two firms operating taxicabs in Brooklyn will follow the lead of Manhattan companies in raising rates. Announcement to this effect has been made by managers of both Brooklyn concerns.

CONTROL OF MOTOR CABS IN NEW YORK.

AS A result of a public discussion of the abuses which have arisen in connection with motor cab traffic in New York it has been decided to draft an ordinance which will put the machines under the control of the bureau of licenses, cause the revocation of licenses of drivers found guilty of extortion, compel official inspection of registering instruments, put the machines on the same footing with horse drawn public service vehicles, and force the attachment of taximeters to front wheels.

While the city may not have the right to regulate the fares of the taxicabs that are used exclusively for hotel and restaurant trade, it has the right to prevent overcharge. If the chauffeur attempts to charge more than the advertised rate of the taxicab companies, then it is extortion and the city can stop it.

A representative of the Merchants' Association, who spoke at the meeting, called attention to the fact that a chauffeur now gets a license from the state. The city does not examine him and has no proper control over his actions. Boys of 16 or 17 years of age are put in charge of taxicabs, with results which anybody can foresee. There are "academies" which advertise to turn out competent chauffeurs in ten days for $10, and it does not seem to be difficult for such accomplished drivers to get licenses. The whole procedure does not deserve to be dignified by the name "system," and so long as it is allowed to run along at such loose ends the situation will continue to grow worse. It is almost intolerable at present.

A Pittsburg man has built a motor propelled fire engine, for which a road speed of 87 miles an hour is claimed. When the fire department chief's attention was called to it, he sagely remarked: "Too much speed: if it travels fast enough to best the horse that is all we require."

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Wagon Maintenance

Tips to new drivers and caretakers about things which are likely to escape their attention.

CONSIDERABLE expense usually attends the repair of enlarged cylinder bores in gasoline wagons which have been in service for a long time. The wear is found high up in the cylinders, the bore at the base remaining as it originally was. Some are content to fit new piston rings of slightly larger circumference, but this plan is not wholly satisfactory, as the rings are necessarily small enough to enter the unworn portion of the bore, and when they spring out in the worn portion, where their work lies, there is too large a gap at their slots. Thus repairers prefer to fit new cylinders and new pistons whenever the customer will sanction the outlay. This outlay is none the less unnecessary, even when the wear of the bore amounts to 2 millimeters, measured diametrically, as it often does in old vehicles. If the new rings be made with long step cut ends, they will pass the unworn bore easily, and yet there will be no gap at their ends when they spring out in the enlarged bore. One precaution is, however, essential. The grooves on the existing piston are usually too narrow to take step cut rings, and the rings will soon snap off at the steps. The grooves must, therefore, first be turned out to a greater width, and the new rings turned to fit. Full compression is thus restored.

* * *

The Repair of Leaky Radiators.

When radiators leak badly the only remedy is to get new ones or send them to the makers and have them repaired. In the case of small leaks, to attempt to repair them by soldering often results in leaks somewhere else. But as a makeshift in the case of a radiator that "weeps" along the edge of the cells, a thin mixture of fine oatmeal may answer temporarily, but it should be as fine as it can be got. Two tablespoonfuls of flour should be put in a jug, damped slightly, and mixed into a smooth paste absolutely free from any lumps. More water can then be added till the jug is full, and the whole mixture can then be poured into the radiator. It will be found that the flour, which will do no harm to the pump or any part of the circulatory system, will gradually work into the leakages of the radiator and stop them up, so that after two or three days' use the leakage will be entirely cured. The one objection to this remedy is that it is impossible to prescribe it as a certain cure.

* * *

Premature Ignition.

Occasionally an engine, which has been running perfectly, will begin to give forth a slight tapping sound. It is not sufficiently pronounced to be called a knock. It is in the majority of cases put down to some slight peculiarity of the valves. As a matter of fact, it is nothing of the kind, but is due to slightly premature ignition. Of course, when an engine begins to labor with the ignition too far advanced, there is no doubt whatever as to the cause of that thumping; but the comparatively light tap caused by only very slight premature ignition is not usually recognized as the first sympton of too advanced firing. It will be found that this tapping invariably occurs when some slight increase in resistance, either through an upgrade or traffic slack, causes the engine speed to be momentarily reduced. When this transpires the retarding of the ignition by a notch or so will put the matter right at once.

* * *

Misaligned Steering Wheels.

When the steering wheels are out of alignment, as may be discovered from indications of unequal tire wear on the two front wheels, it is important to determine whether the difficulty is due merely to bent connections or knuckles, or whether a flaw exists somewhere in the metal. In such cases it is well for the owner to ascertain for himself the real cause of the trouble rather than trust to the superficial inspection of his driver.

* * *

Effect of Carbon Deposit in Engine Cylinders.

Steam engineers are well aware that incrustations upon the heating surfaces of boilers, in any appreciable amount, decreases the steaming efficiency to an inordinate degree. Thus a coating on the tubes ¼ inch in thickness necessitates a 60 per cent increase in the fuel supply for the same amount of steam production, or, with a constant amount of fuel burned, a proportionate decrease in steam production. The same principle applied to the internal combustion engine accounts for the irregular performance of motors which are overburdened with carbon deposit. Decreasing the ability of the walls to transfer the surplus heat of the cycle to the cooling water, results in a rise in the mean cylinder temperature, sometimes involving a slight increase in power at first, but ultimately resulting in pre-ignition.

* * *

Effect of Mud on Radiator.

If mud, which has become splashed on the radiator fins, is allowed to remain, it will prevent the full conversion of the heat and reduce the efficiency of the cooling system. It also will tend to cut down the cooling efficiency by reducing the area of the air passages.

* * *

Replacing Driving Chains.

When driving chains have been removed for cleaning or repairs difficulty is sometimes experienced in replacing them. The operation will be facilitated by wrapping the chain around the wheel sprocket and bringing the ends together on the top of the jackshaft sprocket which forms a table or anvil, and renders the insertion of the connecting link easy. The future removal of the link will be aided if, in replacing it, the detachable side plate is placed on the outside, so that the retaining cotter pins or snap springs are easily accessible. The ends may be drawn together so that the link can be easily inserted by slipping a piece of annealed wire with a loop in one end between the links of each end of the chain after passing the free end of the wire through the loop, drawing it taut, thereby taking up any slack in the chain. The advice is old, but seems to require repetition.

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TO SELL MOTOR WAGONS IN NEW YORK.

VERY extensive preparations have been made by the Motor Truck Company, of New York City, to sell commercial motor vehicles of all sorts and ratings. The general manager of the company is Charles E. Stone, who for years has been fortifying himself with information pertaining to motor wagon transportation and is, therefore, unusually well equipped to push the present enterprise to success.

The company's establishment is located at 244-250 West 49th street. Its stock is almost exclusively controlled by W. L. Nichols, of the firm of D. P. Nichols & Co., builders of horse cabs and carriages, who for three years past have been selling Frayer-Miller trucks throughout New England. The Motor Truck Company will not confine its efforts to the sale of Frayer-Miller machines, but will handle any good product which has been tested and bears a reputation for economic performance. The demonstration and repair departments are in charge of factory experts. The machine shop is well equipped.

One of the aims of the company will be to have a representative call upon every customer at least once in ten days, so that any trouble which may arise in connection with the operation of the machines bought will not, to their disadvantage, be smothered. Another purpose of these periodic visits to customers will be to acquire exact information pertaining to the cost of operation.

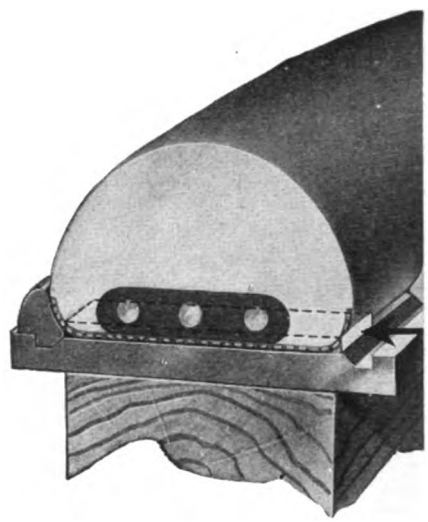
The Nichols company also intends to open agencies in Washington and other eastern cities in which they have business connections. It is interesting to remember in connection with this undertaking of the Nichols company that the firm for years has been recognized as the most important factor in the production of hansom cabs in the east. The wood-working department of the Nichols company will undoubtedly find a large outlet for its productive facilities in supplying bodies for the motor trucks which its subsidiary companies will sell. Already it is doing a large business in supplying motor cab bodies.

BIG ADDITION TO TIRE PLANT.

WHEN Morgan & Wright, the tire makers, moved into their fine new factory in Detroit two years ago, it was thought that the growth of business for years to come had been provided for. Last year the capacity of the plant, working night and day, was taxed to its utmost to fill orders promptly, and it was decided that an addition would be necessary to meet the requirements of this season's business. Building operations, nearing completion, will increase the floor space of the big plant by over 20 per cent.

HIGH MILEAGE FOR BUS TIRES.

ABOUT a year ago the Fifth Avenue motor buses in New York were equipped with Goodyear hard rubber base tires. The frequency of stops, skidding and brake applications, not to mention the great weight of the vehicles when loaded, and their relatively high road speed, combine to make this class of service very severe upon



wheel equipment. These tires have now given over 17,000 miles of service and, barring natural wear on the tread, are still in fine condition.

The hard rubber base, in which the wires are imbedded, is so united to the soft rubber that they are practically one piece and cannot be torn apart under the heaviest loads. The tire is fastened to a special rim, with which is used a split side ring or flange countersunk in a groove in the base rim, which, when riveted to the base rim, makes all practically one piece. The tires are prevented from creeping by metal cleats fastened at intervals to the tire seat of the rim. These cleats fit into slight depressions in the base of the tire.

RAPID COMPANY IN NEW FACTORY.

THE Rapid Motor Vehicle Company now occupies its new factory, which affords four acres of floor space. H. G. Hamilton, general manager of the company, reports eighty per cent more business on the books at this time than in the busiest season last year.

The state of Massachusetts has about 700 miles of scientifically built highways.

Electric buses are used in long-distance service in Bavaria, fresh batteries being supplied at relay stations.

The "Exide" Battery is used in OVER 90% OF ALL THE ELECTRIC VEHICLES MANUFACTURED.
Remember this unqualified endorsement by the leading Electric Vehicle Makers when buying your car or renewing battery.
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The Power Wagon

A Journal for Those Employing Commercial Motor Vehicles

No. 55 JUNE, 1909 No. 55

PUBLISHED THE FIRST OF EVERY MONTH BY

THE POWER WAGON PUBLISHING CO.

SUBSCRIPTION RATES:

One Year (Domestic)	$2.00
One Year (Foreign)	3.00
Single Copies	.20

PUBLICATION OFFICES:
THE METROPOLITAN BLOCK
Chicago, Illinois.

Advertising Rates on Application

WALTER WARDROP, Editor

Entered as Second-Class Matter December 2, 1907, at the Postoffice at Chicago, Ill., Under the Act of Congress on March 3, 1879.

Huge Motor Wagon Project

Three hundred machines to be used in the service of one firm which aims to be independent of railroads

WE ARE now in the period when capitalists and experienced administrators can clearly foresee a much broader application of the motor wagon than is witnessed today. Many big undertakings are being quietly hatched out, and it is certain that some of them will shortly materialize.

The skeleton of one gigantic enterprise is already well articulated. Its author is prepared to begin operations with 300 five-ton machines, which will perform service now exclusively assigned to English railroads. The details of this immensely interesting project are still withheld from the public, even the name of the promoter being kept secret. What we are permitted to learn of the undertaking is found in the pages of a British contemporary, which says:

* * *

"A great master of industry has decided to move in the matter of large scale organization of road transport by motor wagon. He is a man of vast experience and huge resources, who is desirous of conducting the whole of his transport independent of railways. He is an organizer of the highest caliber; he controls a world wide business as one man; he has achieved success in the face of unparalleled opposition. Will he fail in this intended by-passing of established means of communication? A number of coast stations are to be selected, and road distribution from these will take place to the exclusion of railway service in any shape or form.

"There is here forecasted an undertaking worthy the brain and faculties of a Napoleon, for difficulties will be created by displaced interests. Not less than 300 gasoline lorries, each capable of taking five-ton loads, are at present down on the 'paper' scheme, and these, according to present estimates, will require to be supplemented by more of the same load capacity, or others of lighter construction."

The annual tonnage of the firm whose chief executive thus proposes to be independent of rail transportation, is about 150,000, which amount, it is scarcely necessary to say, is not enough to keep 300 five-ton road motors actively employed. It is understood, however, that the machines will haul other products than those of the establishment in question. The purpose of establishing coast stations is to accommodate light draft steamship service, which on account of its extremely low cost is to be utilized in supplementing the work of the motor wagons wherever such conjunction is deemed advisable. The steamships, it is expected, will touch at selected landings on rivers and canals, where their cargoes will be loaded on the road machines and carried to destination.

* * *

This is not the first time such an extensive plan of operations has been considered by wealthy men of affairs. It is well known that Lord Iveagh, the Irish brewer whose huge plant is located in Dublin, conceived a similar design some time ago, and reluctantly abandoned it upon learning that the roads it was proposed to traverse were too weak to sustain the traffic.

Railroads, with their high freight charges, costly terminal delays and slow running time, fairly invite competition from the motor wagon. Only through rail freight is moved with dispatch. The ordinary freight car does not travel more than 25 miles a day, if so much. And, then, think of the number of handlings which all rail freight must undergo in passage from shipper to consignee. The intolerable delays in clearing yards is another disadvantage of rail freighting. A carload of merchandise shipped from Cleveland, Ohio, to Chicago, a distance of 350 miles, will ordinarily require ten days for transport. If the car is to be placed at a siding on the north division of the latter city, an additional 15 miles let us say, from

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three to five days more will be required in order to clear the congested yards. It is, therefore, irony of speech to say that rail freighting is so superior in character as to forbid motor road freighting from competing with it. The truth is, the latter has possibilities even greater than the former. When it is well matured it may be that it will monopolize all short haul traffic, and a large share of that which is not so designated.

* * *

A brief study of English rail freighting will help readers to decide if motor road transport can successfully compete against it. Competition between parallel lines no longer exists. Combination is the order of the day, and with combination have appeared the same evils against which the people of the United States have been struggling. England is practically at the mercy of its railroads. Its population is concentrated to a larger extent in towns than here, and is more dependent upon the iron ways. Only a small percentage of the internal commerce is water carried. Retail and wholesale dealers do not stock up heavily with goods, but use the railroads to fill orders.

The great central fact which is concerning the English people is that there has been an almost complete suppression of competition between the lines. The roads were built up on the theory that they should compete, and the government and the people trusted them to observe this principle. Only one important system has preserved its independence, the others having adopted the "community of interest" plan. Various combinations have been made in Scotland without parliamentary approval, and no competition whatever exists in that country.

The railway and canal act of 1888 declares that "whenever any person receiving or sending or desiring to send goods by any railway is of the opinion that the railway company is charging him an unreasonable rate of charge or is in any other respect treating him in an oppressive or unreasonable manner, such person may complain to the board of trade. The board of trade, if it thinks there is reasonable ground for the complaint, may thereupon call upon the railway company for an explanation and endeavor to settle amicably the differences between the complainant and the railway company."

If the board fails in this negotiation, it submits the matter to parliament, where it usually rests unnoticed. The commission sits only about one month in the year, and has comparatively few cases, primarily because of the uselessness of the proceeding, and also because of the great expense the complainant must bear.

The Minneapolis public library is using a light motor wagon for the distribution and collection of books to and from its branches. The machine is doing the work of two horses and effecting an economy of 50% in running time.

The motor cab has made its appearance in South Africa despite the organized opposition of 600 horse cab owners. The vehicles are operating in Johannesburg.

OHIO'S MOTOR-TRUCK LAW.

FOR a while it was thought that commercial motor vehicles were exempt from the provisions of the law recently passed in the state of Ohio covering the registration and licensing of automobiles. It appears, however, that such is not to be the case.

The next registration must be made on January 1, 1910, when new number plates, different in design to those now in use, will be issued. Owners desiring to retain the numbers they are now using may do so by giving notice and filing application for registration thirty days prior to January 31.

The act, in its amended form, is intended to provide for the registration, identification and regulation of motor vehicles of all kinds, except those which run on rails. An owner is defined as a person actually in possession of a vehicle or renting it under lease or contract for a period greater than thirty days. The annual registration fee is fixed at $5 for a gasoline machine and $3 for an electric machine. Agents are required to pay a registration fee of $10 for each brand of machine they handle.

One of the sections of the act deals with the subject of vehicle speed. It is set forth that "no person shall operate a vehicle on a public street or road at a greater speed than is reasonably safe for the general welfare." The next section defines this "reasonable speed" by prescribing 8 miles an hour in business and closely built portions of the municipality, 15 miles an hour in other parts of it, and 20 miles an hour on the open highroads.

Drivers of all machines are to pay an annual registration fee of $2. They will also be compelled to wear a button on a conspicuous part of the clothing in sign of the fact that they are lawfully registered.

The last section of the act provides that all moneys derivable therefrom shall, under certain conditions, be maintained as a fund for the improvement of the state highways.

It is probable that a motor bus line will be operated between Albany and Schenectady, N. Y., unless the trolley line commutation rates are restored between the two points. If the bus service is established the fare will be 20 or 30 cents less than the trolley fare.

The police authorities have ordered all motor cab and bus proprietors in London to fit their vehicles with a device which emits a loud and continuous noise when a fixed speed is exceeded.

If sufficient financial encouragement is given, the Commercial Transportation Club of North Crandon, Wis., will put three 24-passenger motor buses in commission between that point, Hiles and neighboring towns.

Motor bus service is to be provided between Sharon and Mercer, Pa. Four machines, each seating 12 passengers, will make hourly trips over the macadamized road connecting the two cities.

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Big Horse Service To Be Converted

Twenty-five machines bought for package delivery work in New York City and environs

WHEN the largest and most highly organized package carrying service in New York City, serving 66 prominent houses, definitely decides to purchase power wagons and quickly retire all its horse drawn vehicles, the economy of mechanical road transport must be regarded as very convincingly established. Astute observers hardly needed this latest example of progressiveness to confirm the faith which investors have in the machines. It is, however, decidedly helpful in combating the prejudice and hostility of reactionaries who annoyingly persist in imagining that further experiment is necessary before the motor wagon can be considered commercially acceptable.

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Twenty-five electric wagons of 850 pound rating have been purchased by the H. C. Piercy Company, of New York City, which makes a specialty of contract package delivery. Probably before the summer is over the equipment will be doubled.

It is almost a year since this concern solicited aid from the engineering department of the Studebaker company in determining to what extent its service could be benefited by the employment of machines. Investigation of the physical conditions of the business disclosed high refinement of administrative practice, which proved of great value in enabling the experts to make their recommendations. The central plant, located on West Fifteenth street, consists of a six story and basement building containing about 90,000 square feet of floor space. The structure is comparatively new and is practically fire-proof. Two elevators are in service, capable of handling the heaviest motor wagons. The stable fittings with which this building is at present equipped were installed in such a manner as to permit their easy removal whenever the structure should be converted to use as a commercial motor vehicle garage. The building has capacity for 400 horses and 250 wagons. When the equipment is entirely converted there will be ample room for 500 machines.

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In Brooklyn the company maintains a sub-station which will accommodate 50 motor wagons. It is located on Cleremont avenue. Other sub-stations will be located in the Bronx, on Long Island and in Jersey for the convenience of delivery in those territories.

The Piercy company furnishes each of its customers with wagons which to all appearances are private property. The vehicles, however, are much better maintained than would be the case if they were privately operated. Naturally such service commands a premium.

In operating motor wagons the carefulness which has characterized the company's management of horse vehicles will be very apparent. All the details of the new service have been planned by the Studebaker company's experts after a thorough analysis of the entire business. To insure maximum road efficiency of vehicles the owners will adopt such internal administrative practices as the experts have recommended. Very wisely the owners have decided to accept the guidance of the sellers in the performance of these practices while they are qualifying for independent management.

The machines which will be put in service are equipped with single motors and 24 cell batteries. They will travel 30 miles on one battery charge at 12 miles an hour, weigh 2,700 pounds, and are furnished with 36x2½ inch tires in front and 42x2½ inch tires in the rear. The gauge is 54 inches. Side lever steering is employed.

THE WASTEFUL STEAM FIRE ENGINE.

NEARLY every fire chief in the country will approve the following utterances by the head of the New Haven, Conn., department:

"I feel safe in saying that I shall probably never recommend the purchase of another steam horse-drawn engine. It is only a matter of a short time when these engines will be self-propelled. When this is accomplished it will mark a new era in fire department equipment.

"Do you know that it takes 24 tons of coal a year to keep steam up in every fire engine in the department, while it doesn't cost one cent to keep motor vehicles ready for service, and only a few gallons of gasoline are needed for a week at a time. Five coal wagons are used in the department at present for rushing coal to the steam engines at a fire. So you see the passing of the coal wagon is also near at hand. At present the department pays $9,000 a year for feed for its horses, $1,700 for shoeing and $2,500 for new horses, harness, repairs, etc. The department will be saved thousands of dollars when self-propelled vehicles replace the old apparatus."

Motor bus service is to be established between Defiance, Paulding and Bryan, Ohio. Poor railroad service justifies the use of the road passenger machine.

The owners of the largest motor cab company in Boston openly advocate the gearing of machines so that they cannot exceed 20 miles an hour. Other service reforms they urge are: The adoption of a finger-print system of identification for drivers, so that incompetents and drunkards cannot assume false names and obtain new licenses; very severe penalties for drivers who are found intoxicated while on duty, or who overcharge patrons.

The police commissioner of Washington, D. C., is urging the purchase of motor patrol wagons.

The authorities of Atlantic City, N. J., have sanctioned the writing of $10,000 insurance upon the lives of the electrical department workmen who use municipal motor vehicles.

New Castle and New Wilmington, Pa., are to be connected by motor bus. Each machine will accommodate 15 passengers and light baggage.

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Trucking In Textile Mill Yards

Study of transportation conditions which are peculiarly favorable to the use of electric machines

BY DAY BAKER

ONE of the problems which confront every superintendent and yard master of a textile mill is the proper, expeditious and economical handling of the raw material as it arrives, as it passes through the various processes until it becomes "finished goods," and then is delivered to the storehouse or to the freight house, where the responsibility of distant delivery is turned over to the railroad or steamship line.

Not only are the problems of transportation encountered in handling the actual raw material, material in process, and the finished goods, but in many parts of mill work there also arises numerous calls for transportation of some character. Raw material, if not delivered by the railroad direct into the storehouse, must be carted there. Perhaps it is then necessary to team it to the picker room, to start it on its long journey through the course of manufacture. After being spun into yarn, it may be necessary to transfer it to a somewhat distant mill.

The goods, being woven, may have to be carted to the bleaching, the dye house, or finishing departments, and from these departments to the storehouse, and perhaps later to the freight house. Not every mill is so fortunate as to have its coal delivered from the railroad cars or boats direct to its coal sheds or boiler rooms, and therefore many are confronted with the additional problem of the transfer of coal from railroad lines and wharves to their own storage, and from there to their boiler rooms, many mills making two and some three transfers.

* * *

Many Commodities to Be Moved.

After the process of combustion the remnant of the coal (the ashes) must be carted to such places as are being filled, or to the dump. The lumber for the shipping boxes —that does not come in on wings—requires hauling to the carpenter shop, and from there as boxes to the finishing room or shipping department. The barrels of dye and bleaching materials will not roll themselves to the storehouse, and from there to the dye works or bleachery; they must be teamed, and their weight is such that they make heavy loads. Lumber must be moved to the various places around the mill yard where repairs are going on, or if construction work is in progress, bricks, lime, cement, crushed stone and gravel must be carted. These are some of the many problems in mill transportation that confront the superintendent.

Years ago almost the only means employed in transportation in the mill yard was the slow plodding oxen, and even now you will occasionally find a few yoke of them slowly drawing their cumbersome trucks loaded with raw material or finished goods. Later, as the world progressed and speed became one of the requirements, the more flexible and faster moving animal, the horse, was introduced for service around the mills. The horse, man's faithful friend, has done great work, but his day is fast going by, for with the keen competition of the twentieth century we are calling for an increased amount of work in a given time, less manual labor, a speedier transfer of goods, and improved hygienic conditions around our manufacturing communities.

According to one of our best writers on health subjects for the masses, 40 per cent of the disease and deaths accounted for by our hospitals may be directly traced to the horse, which, aided by the wind, the fly and the rat, scatters broadcast death-dealing germs. (See Appleton's Magazine, May, 1908, "The Horse vs. Health," by Harold Bolce.)

It has also been shown by high authorities that delays in work caused by sickness or death among employes are a distinct economic loss, not only to a town, city or state, but also affect the cost of manufacture. Therefore, I say, for the reasons given above, and for the additional reason that a better and cheaper method has been found, the day of the horse for mill yards is on the wane.

* * *

Rails Not Essential.

We no longer weave by hand, nor do we travel by stage coach, and as the world moves so the conditions around the mill change.

In some instances tracks and industrial cars have been installed in the endeavor to better the yard transportation, but the work of almost any mill is of such a varied character that the network of tracks required to reasonably cover the route desired, the cost of laying them, and keeping in repair, more than offset their apparent saving. And then, again, it is often desirable to use the mill-yard vehicles around the town or city, outside of the mill property on the public highways. This cannot be done if industrial rail cars are used. Therefore, trackless transportation in and around the mill is really what is required.

As vehicles operating around a trackless mill yard and town or city roads must be supplied with power, the nature of the motor is first to be considered. Electricity seems to be the most natural power, not only on account of its cheapness, but because of its cleanliness, safety and flexibility. Therefore, the logical method of transportation for the mill yard is trackless, electrically driven vehicles.

* * *

A Mechanical Proposition.

In considering any method of transportation there are three things to examine: the road, the load and vehicle. In trackless transportation the road must be accepted as it exists. In mill work the load must be accepted as it is received, and it must be delivered as ordered. These two factors of transportation are the same, no matter what method is employed. Hills, bad roads, frequent stops and starts, long routes and heavy loads are equal in the demand made on animals or machines of any kind. The third factor, the vehicle, is the only one with which the solution of transportation problems can be made any easier. Just as the electric street car has solved the problems for passenger transportation in cities, so has the

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electrically driven power wagon opened the way for the simplification of transportation problems around mill yards.

The electric vehicle for trucking and delivery is purely a mechanical proposition. It is a machine. Like other machines, it can be built to do a given amount of work in a definite time at a certain cost under any known conditions. The safely carried load in pounds or tons is the basis of its mechanical design and construction. The specified speed with full load on hard level determines how much power will be required. The specified duration of continuous operation at full load on a hard level determines the amount of energy that must be stored in its battery at one time. This last condition fixes the size of the storage battery. The power and speed required determines the size of the motor and the gear ratios, while the total weight affects the tire design.

The cost of transportation by electric vehicles can be determined just as logically as the cost of operation of any other machine. It is merely a question of measuring the work and measuring the cost, and placing one against the other.

Accurate engineering can be applied to the problems of transportation with greater satisfaction with electric vehicles than with any other type. Electrical measuring instruments reveal, and record if necessary, the condition and performance of storage batteries and electric motors. The cost of producing electricity is a known quantity. The amount of electricity necessary to charge a battery is measurable. The amount of electricity delivered to an electric motor by the battery is a known quantity, or can be measured. The performance of an electric motor is accurately specified for any conditions. Its efficiency is easily determined.

* * *

To Overcome the Resistance.

The work of moving a ton a mile an hour on a hard level road is expended in starting it from rest and in overcoming the resistance of the road, the tires, the bearings, the electrical circuits and the air. If the road is not hard or level, of course more work will be required to overcome its resistance, or to move the load up a grade. If it is necessary to start often from rest more work must be done than for continuous motion.

* * *

Have Solved Earlier Difficulties.

It is sometimes argued that electric trucks in the past have not all shown favorable results. The mileage was short, and the batteries lasted but a short time. This is very true. It is also a fact that many mechanical devices introduced a few years ago have not proved as efficient as could be desired, but they have been steps in advancement toward perfection. The state of the art in electric truck and battery building has progressed rapidly within the past two years, so much so that the amount of current required to move the modern truck has been practically reduced 50 per cent, and where two motors were once required to move a given load, the work is now more easily done with one.

The two motor trucks almost without exception required a larger amperage to operate than the guaranteed discharge rate of the largest battery which can consistently be installed in the truck. This results in a constant tearing down of the battery plates, making continual washing of the batteries necessary, and thereby rapidly shortening the life of the battery.

Recently designed electric trucks of to-day, with simple one motor drive, consume very little current compared with the older two motor construction, for the reason that the number of amperes required to operate the new construction truck is less than the discharge rate of the battery, and therefore the battery is not continually working under a strain, and the consequent rapid disintegration of the battery plates, as in the trucks of the two motor construction. And this is not all—the one motor truck requires a much smaller battery—less expensive to repair and replace, and taking less energy to carry itself around as part of the motive power. The comparison follows:

Two Motor Drive.—Two motors; large battery; extra heavy frame required to support motors and batteries; constant over-discharge of the battery required; energy lost by the frequent over-exertion of motor on inner arc of turning radius; mileage, 20 to 30 miles.

Single Motor Drive.—One motor; small battery; light, but rigid, channel steel frame; less energy required for carrying the vehicle and motive power; current required less than discharge rate of battery; all energy utilized by efficient equalizing gear in countershaft; mileage, 30 to 40 miles.

* * *

Advantage in Large Plants.

The electric vehicle cannot be used profitably where it is not needed. Where the work to be done is less than half the ability of the machine, proper value may not be derived from the investment. Where a large number of vehicles is used the advantages of electricity become more apparent and the efficiency of the service is improved still more. Transportation by electric vehicles is a subject simple to explain and easy to demonstrate to the satisfaction of anyone interested. The selection of the proper equipment, however, depends on the engineering sense of those most familiar with the problem.

As most manufacturing companies are familiar with the horse-drawn proposition it is of interest to compare that method with the electric; therefore it may be stated that taking into consideration, depreciation, interest, insurance, stable room, shoeing, veterinary charges, harness, blankets, stable-help and feed, on the horse side of the argument, and the corresponding items against the electric truck, including electric power at 4 cents per kilowatt hour, the actual economy in cost shows in favor of the electric truck by 22 to 53 per cent, according to the size and number of vehicles operated, and the surrounding conditions.

It should be recollected that the electric vehicle requires only the space it occupies. It needs no hay-loft, stalls, harness room, bedding platform or manure pit; nor does it require extra equipment to do twice the work that horses drawing the same capacity per load accomplish. While the stable man is obliged to keep a supply of extra horses to substitute for those which are sick, disabled, or

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being shod, it is not necessary to have extra motor vehicles on hand as 98 per cent of all causes for delay can be provided for in advance and thus prevent or overcome loss of use.

* * *

Takes Up Little Space.

In a small one-story garage, not more than 25 x 50 feet, may be housed the complete equipment of five electric vehicles which will displace and do the work of 9 or 10 trucks and 18 to 40 horses, according to the size of trucks and the method of working horses. One intelligent mechanic and a helper can easily care for these machines and keep them in first-class operating order. Notice the economy in stable room and stable help.

While the heat of summer, the chilling rains of the fall, and the low temperature of winter, to say nothing of the glare, icy pavements and deep snow, all work havoc with the health of the horse and make the death rate high, the electric truck knows no seasons, but keeps constantly at its work the year around, good and bad weather alike. Accustomed as most horses are to moving freight trains and cars, it is nevertheless a fact that quite often a good horse will become frightened and run away, causing loss not only to vehicle, harness and load, but frequently irreparably injuring or killing itself or running mate. These incidents all go to make the horse expensive, and form links in the chain of strong arguments for the electric truck.

Among the many arguments which should be considered by the mill operators in connection with electric motor vehicle work over horse-drawn trucks is, first, the cleanliness in garage and around the yards, the vehicles and the motors driving them running on very generously proportioned ball and roller bearings, which are sealed, oil and dust tight, only require oiling once every six months; second, the electric method is far cheaper, requiring a less number of vehicles, therefore less drivers, and the loading and unloading crews are less, or the present force is kept busier; third, while the electric current for the charging of the batteries is figured in all estimates on which this argument is based at four cents per kilowatt hour, it is a fact that most mills can operate a small wheel or a small engine during the night, furnishing power to charge the batteries, or taking current from the mill lighting plant before the peak of the load, utilizing power which would otherwise go to waste, thus reducing the cost of current to less than a small fraction of a cent per kilowatt hour; fourth, the flexibility in the handling, light or heavy loads carried with equal ease, the turning of vehicle and backing to freight cars, doors, or elevators, and its ability, on account of occupying only 60 per cent of the space used by the horse-drawn vehicle, flexible steering, and starting and stopping devices, to travel in congested yards or buildings; fifth, it can be run into factory buildings, up elevators, into shipping rooms or freight houses, and onto docks and wharves, all of which places are barred to the gasoline truck by insurance regulations; sixth, and most important, the money invested in electric motor vehicle transportation will produce a larger dividend, when compared with present horse costs, than is earned in any other portion of the manufacture of textile goods.

* * *

Story of One Mill's Success.

The facts here advanced are amply justified by the experience of a number of well-known mills of New England which have adopted the electric motor vehicle method. It is perhaps one of the strongest arguments in favor of the motor vehicle to say that all mills with one exception, which have made a primary installation of electric trucks, have after a practical experience ordered additional machines.

The following statement and estimate were made for one of the most conservative mill operators in New England. The cost of land and a large stable building for the horses were not even considered.

Teaming—

Total cost for five years ending December 29, 1907 (not including hired teams for mill coal)	$33,419
Of which, the labor of drivers and helpers	24,961
Leaving as cost of grain, shoeing, harness repairs, horse renewals	$ 8,457
As this is for 10 horses for five years, the cost per horse per year	169

Electric Trucks—

It is contended that a two-ton electric truck can do 30 miles per day on a single battery charge, and that it can easily do the work now done by two double teams. One builder claims more than this.

Cost complete, including battery, etc.	$ 3,400
Estimated cost of charging equipment, to charge three trucks	250
Spare parts, in case of accident	350
Amount invested in electric truck, etc.	$ 4,000
For comparison with horses, deduct estimated value of four horses, carts	1,000
Excess amount invested, say	$ 3,000

Expenses of Motor Truck—

Interest on investment, 6 per cent	$ 180
Depreciation, 10 per cent (batteries and tires below)	310
Batteries, $207; tires, $235 (each said to run one year)	442
Two men to operate truck, one at $1.75, one at $1.25	900
Cost to operate motor truck one year	$ 1,832
On the basis of last five years' cost of teaming, the displacing of four horses, four men on two double teams, would be:	
Four horses at $169.17 a horse	$ 676
Four men at same rate as above	1,800
	$ 2,476
	1,832
Saving by the use of one motor truck	$ 644

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If more than one machine is used the saving would be greater.

* * *

Showed Saving of $226 a Month.

As a result of the investigation, two General Vehicle Co.'s motor trucks were installed. The mill teaming account was $6,800 a year, or $569 a month, but by the additions of the first two machines a saving of $266 a month, or $3,200 a year, has been shown. Of course, this high rate can hardly be maintained, but a handsome saving can and will be shown in the following years, which will make the truck investment one of the most profitable.

In one of the largest mill corporation plants in the United States, four electric trucks have been installed, displacing about 30 horses and the many wagons and trucks which it was necessary to use.

In another cotton manufacturing industry a five-ton electric vehicle was installed, working 10 hours a day, taking the place of three horse-drawn trucks. Later, the enterprising engineer of this mill proposed purchasing an extra battery, putting on a night crew and operating the truck 20 working hours per day. This has been done, and as a result the entire stable has been dispensed with, and the machine truck is now doing the work which before required seven horse-drawn trucks.

With the advent of the machine truck has come advanced methods in handling the loads which they are called on to carry, and on this portion of the problems of mill yard transportation, I trust that I may have the pleasure at a later date of presenting another paper.

GATHERING EGG SUPPLIES BY MOTOR WAGON.

THE variety of service in which the motor wagon is employed would indicate that its use is not being fostered by a few transportation specialists having peculiar need for it. The catholic character of its application confirms the observation so often encountered in trade circles, namely, that there is scarcely a service in which the machine's utility and economy has not been demonstrated.

The wholesale gathering of eggs for market, however, is a form of service which until recently was not performed by the machine. Collection of this form of merchandise in itself presents no unusual conditions. It is its novelty alone which makes it interesting. A produce concern doing business in Wabash, Ind., employes a machine in making the rounds of farms in the local county where egg supplies may be obtained. This machine does the work of three horse-drawn wagons and thoroughly covers the territory to which it is assigned, going as far north as North Manchester. It reaches the city four times a day.

Oil City, Pa., is to be provided with a motor hose and chemical wagon.

Large flags are used to indicate the approach of motor driven fire department vehicles in New York City. The same practice will be put into effect in operating motor police wagons in Cincinnati.

MEANING OF THE KILOWATT HOUR.

MANY are puzzled to understand the peculiar significance of some of the terms used in denoting the measurement of electric current. The words "amperes," "volts" and "watts" slip easily off the tongue of those who are familiar with the language of electrical science, but it is not very well appreciated how many owners of electric wagons are unable to comprehend their precise meaning. The "kilowatt hour," however, gives more trouble than any of the other terms.

To explain this term needs first a clear definition, and then a comparison. Everyone will understand that a certain amount of force must be used to drive electric currents through a circuit. This force is measured by volts; thus we have 110-volt currents and 220-volt currents, the one expressing just twice the force of the other. But the quantity of current passing through a circuit depends upon the force and the resistance, and so the quantity is expressed by a different term, viz., "amperes." Now the efficiency of the current depends upon both force and quantity, and to express this efficiency or united action we multiply the force by the quantity—that is, the volts by the amperes—and express the result in watts. Thus 110 volts multiplied by five amperes is 550 watts, or 220 volts multiplied by five amperes is 1,100 watts.

A kilowatt is, of course, 1,000 watts, which is equivalent to about one and one-third horsepower. In charging a battery the lighting company's bill for the use of so many watts for so many hours—thus 1,000 watts for ten hours—would be charged as ten kilowatt-hours, which at 5 cents a kilowatt-hour would be 50 cents, a charge that seems little enough for ten hours' use of one and one-third horsepower.

But what a kilowatt hour is worth may best be judged by what it will do. Thus a kilowatt-hour will light twenty sixteen-candlepower incandescent lamps or two standard arc lamps for one hour; it will pump 100 gallons of water to a height of twenty-five feet; compress 470 cubic feet of free air 100 pounds; drive an ordinary passenger elevator 1,750 feet; print 2,500 circulars on a 15 x 21 Gordon press or 1,000 sheets on a 32 x 47 cylinder press; run a sewing machine for twenty hours; supply air for a church organ for one service; mix two and one-half cubic yards of concrete; heat a two-pint chafing dish for four hours; mix sufficient dough for 1,500 loaves of bread and grind 600 pounds of coffee; it will drive a runabout four and one-half miles or a three-ton truck one mile. When, therefore, a lighting company charges 5 cents a kilowatt-hour for current for your electric vehicle, you can estimate the value of what you are getting by what it will do in other lines of industry.

Traffic regulations in New York City are soon to be supplemented by a device which will indicate when vehicles are to go ahead, stop, and turn to the right or left. This device is in the form of a screen carrying the necessary wording, and placed over the lens of the tail lamp of automobiles especially. A flexible wire connects the screen with the driver's seat and thus signals the driver back of him as to his movements at all times.

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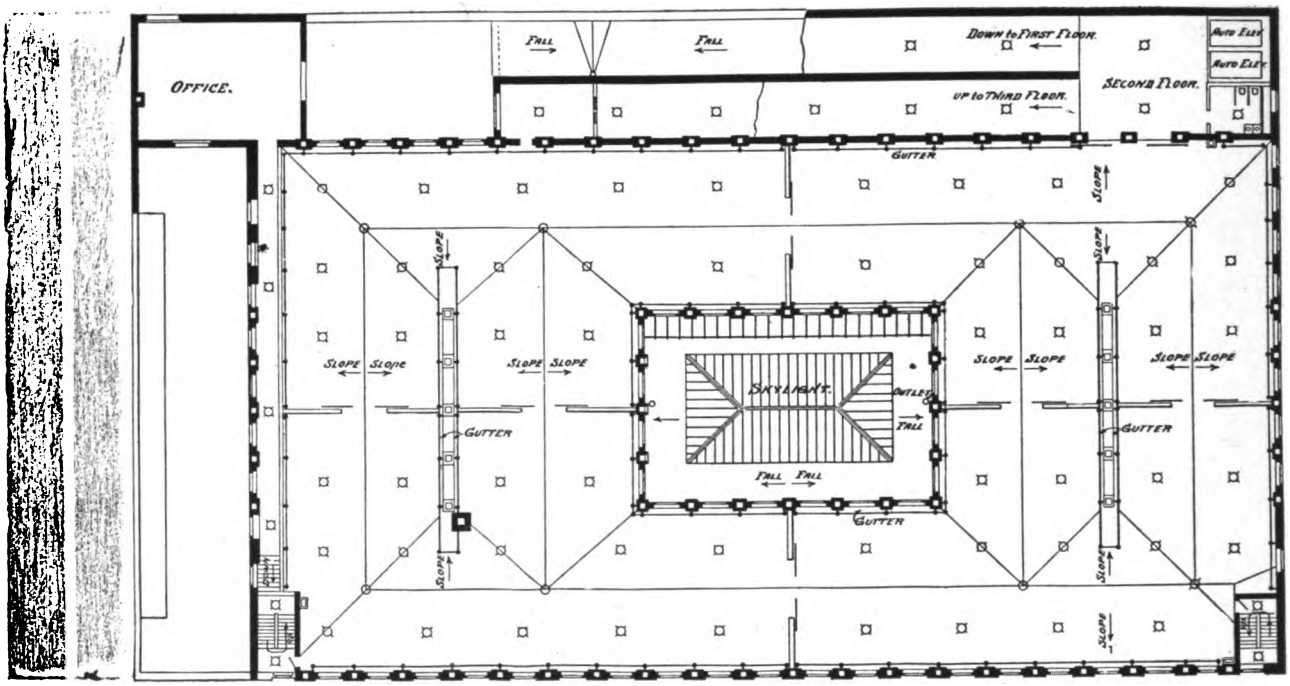

Ground floor plan of New York Motor Cab Company's recently completed garage, which will accommodate 700 machines.

The Commercial Vehicle Garage

Model establishment for the housing and maintenance of a large number of motor cabs

INTELLIGENT anticipation of the stable conditions necessary for the economic administration of a large number of motor vehicles engaged in hauling merchandise is a matter to which comparatively few have addressed themselves. Existing practice is to house all the machines upon the same floor of a building, whose site is selected with little regard either for the business to be served or the convenience of the rolling stock.

There is one establishment in New York, employing 25 electrics, which receives them on the ground floor, conveys them by elevator to the next, where they are charged, and utilizes the upper floors for repair work and the storage of materials. The disadvantage of this method of stabling is quite obvious. Any considerable increase in the equipment would overtax the elevators. The truth of this observation is very well demonstrated in the stable methods employed for taking care of large numbers of gasoline motor cabs, which, where good practice obtains, use inclined runways instead of elevators. The commoner form of garaging, however, consists of huddling together as many machines as can be conveniently crowded upon a given ground floor space.

* * *

It is quite likely that motor cab stabling practice, whatever it may be, will for some time be the guide for concerns which use large quantities of motor wagons. On this account the design of the New York Motor Cab Company's recently finished garage is possessed of much interest. The establishment is equipped to contain 700 machines. Every detail of it is indicative of the forethought which must be exercised in order to insure rapid and efficient handling of the vehicles. The building covers ground measuring 225 by 145 feet, the office being separate from the structure in which the vehicles are stabled. The garage proper consists of four stories and a basement. It is made of brick and cement. Other stories may be added when necessary.

The inclined runways are made of reinforced concrete. Each runway is about 100 feet long and has a grade of 8 per cent. A fire-proof wall separates the runways. The landing stages are large enough to permit of turning a cab by its own power into the adjacent incline without reversing or maneuvering. Rails of 2-inch piping afford protection to the walls and fixtures from erratic steering.

* * *

The floors will carry a load of 120 pounds to the square foot. They are graded from the center to the edges in order to permit the washing water and lubricating oil to be carried off to gutters formed in the floors alongside of the walls. Water connections for washing are provided at 25-foot intervals.

In a corner of the building two elevators are located for the hoisting of disabled machines. The electric motors for these elevators are placed on the roof, a position selected on account of the unwillingness of insurance companies to write a policy upon any basement equipment likely to cause fire. All the windows have metal frames and sashes, and wire glass panes. Some are of the automatic closing type favored by insurance companies, pivoted slightly above their centers so as to close by gravity. Two chains hold them open, each having a connection which is easily destroyed by fire. When this occurs the windows automatically close and lock.

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The doors which separate the inclined runways and disabled vehicle elevators from the remainder of the building are sheathed in tin and designed to close automatically whenever their fusible connections are burned. Heat radiators are placed around the walls midway between floors and ceilings. Steam heat is used.

In the basement an oil separator is located. All the water used in the building, except that flowing from the toilet rooms, is passed through this machine, and the oil with which it is mixed is recovered. The locker room is located under the runway, its compartments being made of steel. Here, and elsewhere throughout the building, there are abundant signs of the great care which has been exercised in order to make the whole establishment as nearly fireproof as possible.

* * *

In the court yard on the first floor the machines are supplied with fuel before they pass out into the street. Adjoining it is the bay by which the machines enter the building. Sheet steel doors separate this bay and courtyard. On this floor are also located the watchman's room, the switchboard, the checker's room and three other bays used for general repairing, storage of materials and vehicles, tire storage, and the clock department. Fuel is stored in the courtyard, the system installed providing eight delivery pipes.

There are four sections on the second floor, separated by fireproof partitions and doors. There are two washing stands in the corners of this floor. The third floor is similar in design to the second. The fourth floor, with the exception that it is provided with four washing stands, is also similar to the second floor. Repairs to the chassis and body are effected on the fourth floor, which has four concrete pits built into it. This floor is also provided with work benches and assembling stands.

The gasoline storage system is a very interesting feature of the establishment. Neither pumps nor valves are used in raising the fuel to the desired height, and the fire authorities state that it is impossible for explosive gases to accumulate. As the fuel is delivered from the top of the storage tanks it is impossible for water or sediment to pass into the fuel receptacles of the cabs. Eight vehicles can be supplied at one time, each driver filling the tank on his machine without leaving his seat.

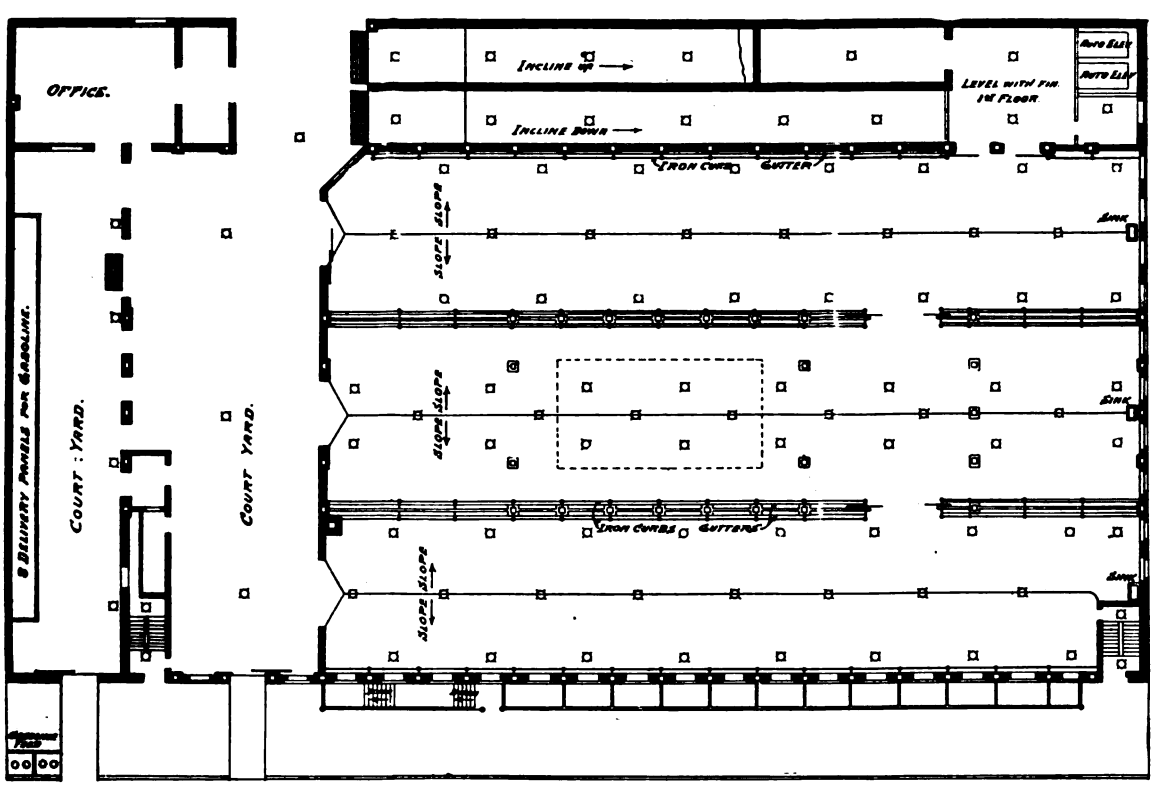
A SAVING OF $25,000 A YEAR.

AS A result of the lessened cost of maintenance which would follow the employment of motor police wagons the director of public safety in Philadelphia is anticipating an annual saving of $25,000 a year. This official is urging the complete abandonment of horse-drawn patrol wagons before his term of office expires.

At present more than 200 horses are required for Philadelphia's municipal police and ambulance service. Funds are available for the immediate purchase of two machines, but it will be necessary to secure the co-operation of councils before the wholesale supersession already referred to can be accomplished.

TIRE PLANT DESTROYED BY FIRE.

THE plant of the Lockport Rubber Works at Lockport, N. Y., was destroyed by fire on April 28. The loss was in excess of $200,000, covered by insurance. The company was established a year ago with capital stock of $300,000, to manufacture tires of all kinds. The future plans of the company have not yet been announced, although it is understood that it is the intention to build and equip a new plant.



First floor plan of New York Motor Cab Company's garage.

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Electric Bus Operation

Records which indicate that the service of this type of vehicle is highly approved by the public

EXAMPLES of electric bus service, upon a scale sufficiently large to attract public notice, are so scarce as to greatly enhance the value of their service records. So far as is known, only two such services exist, or have existed, one in London and the other in Philadelphia. Unhappily, the Philadelphia enterprise is not being actively operated at present, although it is reported upon very good authority that its 29 machines will soon be on the streets again. Abandonment of the service was forced by creditors of the operating company, their action being induced by the fact that the machines were not on a paying basis at the nickel fare charged. As stated in the July, 1908, issue of this journal, the cost of operation was 20.9 cents per vehicle mile, charges of every kind included. The gas-engined gear driven London motor bus, operated in lots of 300, costs 20.212 cents per vehicle mile, while the gasoline-electric bus in the same service is operated at 17.040 cents per vehicle mile.

* * *

The curious thing about electric bus service in London is that the company operating such machines calculates it can make money at a two-cent fare, with total operating expense of 19.98 cents per vehicle mile. Hence it is clear that either the administrative method employed abroad is superior to that practiced in Philadelphia, or else the machines themselves are endowed with virtues not possessed by vehicles of the same family in this country. The machines, both in London and Philadelphia, are of the four wheel drive variety.

As the London installation alone survives it will be interesting to follow the plans which its operators have in mind for the extension of the service. In this connection, it is important to remember that London street vehicle traffic is wholly unlike that encountered elsewhere. In the first place, the development of surface rail transportation is in a very backward state, motor buses, horse-drawn buses, horse-drawn cabs, motor cabs, a limited number of trolley cars, and underground trains monopolizing passenger traffic. The vogue of the London motor bus is not very well appreciated, even by those who have observed its extensive operations. Three years ago, when it was first introduced, and at a time when not more than 300 machines were serving the public, upwards of 187,000,000 passengers were transported in a twelve month. Last year approximately 407,000,000 passengers were carried in the 1,100 machines in commission, these machines earning, at two-cent fares, about $8,750,000. There is, of course, nothing comparable to this form of service anywhere in the world. On the other hand, it would be unfair to conclude that its proportions can be duplicated in any other city.

* * *

The London Electrobus Company is now appealing to the public for more money in order to extend its business, stating that it began operations in July, 1907, with the service of six machines. At that time there was a great outcry against the noise and odor of gasoline buses. The silence and odorless operation of the electric vehicles was enough to give them instant popularity, and at the end of three months the little fleet had carried 179,909 passengers, the receipts being a shade under 26½ cents per vehicle mile. When these figures were made known critics declared that the comparatively large number of passengers and revenue per bus mile was due to the novelty of the machines as much as to the fact that only a few of them were in service. The accuracy of the last assertion may be doubted with good reason, as it developed, during the quarter succeeding the period just mentioned, that with an increased equipment 925,959 passengers were carried, receipts being over 28 cents per vehicle mile. Popular fares prevailed, a ride of about 1½ miles being available for two cents.

* * *

At the close of last November the total number of passengers which had been carried by the London electric buses was close to 3,000,000, at which time the machines had been in operation 15 months, the average number of passengers carried per trip by each machine being 11, and the receipts per vehicle mile 28 cents. In this connection the following comparisons of London passenger vehicle service will be interesting, the period under consideration being a year, ending last July:

	Gasoline Buses.	Trolley Cars.	Electric Buses.
Average seating capacity.....	30	60	34
Number of passengers per vehicle mile	6	10.35	10.75
Average receipts per vehicle mile, in cents	16	22.26	28

The batteries of the electric buses operated in London are maintained under contract at a rate of four cents per vehicle mile. Since it began service the operating company has had several offers to maintain the batteries of a hundred machines at the rate for a period of three years.

* * *

During the first twelve months the earnings of the London electric bus only exceeded operating expenses by $3,565.96. Naturally this sum was not sufficient to pay the establishment and overhead charges of the operating company. For the three months ending October 15, 1908, however, profits on operating amounted to $7,326.90, which is just about enough to cover expense of every kind, amounting to about $30,000 per annum. Here it is important for readers to remember that establishment and overhead expense attending the operation of electric buses would not be materially increased if the size of the fleet was doubled.

Each machine in the service of the London Electrobus Company is actually traveling about 24,500 miles per annum, and on the basis of present profit is annually earning $2,151.10. The company is now aiming to operate 80 machines, the annual profit from which should be about

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$57,088. Its record of service for twelve months ending July, 1908, is as follows:

Number of passengers carried	1,596,831
Receipts	$41,892.66
Average receipts per bus mile	27.60 cents
Operating expense	$38,326.70
Profit on operating for the year	$ 3,565.96

The above figures are certified as accurate.

The following records of service are available for three months' operations ending October 15, 1908:

Average daily mileage of each machine	67.2
Number of passengers carried	925,950
Total receipts	$24,032.84
Receipts per bus mile	28.76 cents
Total operating expense	$16,705.94
Average cost per bus mile	19.98 cents
Profit on three months' operations	$ 7,326.96

The operations of the last period dealt with would seem to confirm the commercial value of electric buses, and on that account readers will desire to know more about the details of the administration. To gratify this pardonable curiosity the following tables of income and expenditure for the three months ending October 15, 1908, are presented:

Income.

Traffic	$23,313.42
Advertisements	719.42
	$24,032.84

Per bus mile, 28.76 cents.

Expenditure.

	Per bus mile.	
Drivers and conductors	5.74	$ 4,804.42
Washers, cleaners and yardmen	82	619.56
Battery hire	3.98	3,337.98
Tire hire	3.38	2,824.50
Power, excluding "forming expense"	2.10	1,768.14
Power wages	.20	171.60
Repairs to rolling stock and plant	.96	809.48
Wages on same	.58	494.42
Rates, taxes, rent, gas and water	.98	819.88
Garage, clerical wages	.14	129.36
Licenses	.10	86.40
Insurance	.84	691.20
Accidents	.10	84.40
Punches and tickets	.04	44.80
Printing	.02	19.80
Total operating cost	19.98	$16,705.94
Profit	8.78	7,326.90
	28.76	$24,032.84

The above statement does not include establishment, supervision or head office charges, nor repairs to buildings, but the total of these, excluding depreciation, for the three months ending October 15, 1908, was $7,279.58.

The Motor Wagon Company, of Schenectady, N. Y., has been organized with capital stock of $25,000.

NEW YORK'S PARADE.

THE industrial motor vehicle section of New York's recent automobile parade disappointed those who fancied its proportions would be greater than last year. Only 60 machines were in line. Eleven of these were disguised touring cars bearing advertising signs; 32 were legitimate motor wagons, gas engined, and varying in load capacity from 500 pounds to 5 tons; while the remainder, 17, were electrics rated to carry between 1 and 5 tons.

Only 19 entries were made by owners, the other vehicles participating in the parade being rented to establishments which used them for advertising purposes. An award of $500 was made to the Saurer truck, which was utilized to advertise the product of a tire maker.

Motor wagon agents took little interest in the event. Only a few houses which own business machines could be prevailed upon to spare them from service. Paying wagons, the majority of owners asserted, could be much better employed hauling merchandise than in parading in the company of vehicles with which they have nothing in common. The conjunction of work horses and motor wagons, or a parade of pure business machines, would seem to offer better opportunities than a mixed automobile open air exhibition of the kind under consideration.

CONCERNING BRIDGE STRUCTURE.

THE structure of rural bridges is of much importance to those who use or expect to use the road for mechanical transport. Few of the states aid in the construction of bridges. The entire burden of construction must be borne by the township or local municipality. The result has been that inferior structures, due to lack of funds, are erected. The type usually adopted is a light iron or steel superstructure, with plank flooring and railroad iron pile substructure, or poorly laid rubber abutments.

The life of such bridges seldom exceeds thirty years, and if not promptly replaced they constitute a menace to all users of the highway. The usual renewals consist of placing an inferior iron or steel bridge over the old weakened foundation. The local highway officials, not having technical training, are frequently misled or corrupted by unscrupulous agents.

Bridges constitute an essential part of the highway and should be erected under state supervision and, in part at least, at state expense. The cost of erecting a reinforced concrete bridge is little if any in excess of that of a properly designed steel structure. The cost of repairs and maintenance of concrete bridges is nothing; they endure for ages. Such structures eliminate the probability of accident.

It is calculated that the installation of one $8,000 motor hose and chemical wagon in Vailsburg, a suburb of Newark, N. J., would effect a saving of $42,000, it being necessary to buy new horse-drawn apparatus, build a station, and add to the city's pay roll in order to care for the latter equipment.

Ninety per cent of Berlin's streets are asphalted.

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Fit Roads For Heavy Motor Traffic

The development of rural transport makes it necessary for wagon makers to study highway construction

MEN may use horse-drawn vehicles all their lives and never get beyond the point of saying that roads should be improved. But it is impossible to consider the extensive employment of the power wagon, the motor bus, or any other form of commercial motor vehicle without ardently desiring sound and well maintained highways.

It is to be regretted that the manufacturing fraternity of this industry should see fit to take a greater interest in street improvement than in the larger matter of good roads, for, essential though the former is to their commercial well being, it is undeniable that in the end the rural traffic will be of very great importance. Members of the older division of the automobile industry naturally take a more intense interest in the development of our road system than the makers of industrial vehicles. The former perceive that their market is limited by the condition of the highways, and hence they consider it good policy to do all in their power to produce such physical conditions as will make motor car travel inviting. The economic advantage of good roads to the producers of motor wagons and buses may not be very alluring at this moment, but they are none the less apparent on that account. The road haulage of rural merchandise by mechanical means, relatively insignificant just now, will soon attain such huge proportions as to rival and finally overtop fixed rail transportation.

* * *

What preparations are being made to intelligently anticipate such a condition? Who knows if the road system which it is the aim of the states, counties, motor car tourists and clubs to provide will be suitable for heavy motor traffic? Everything is being left to chance and the badly ordered zeal of a host of enthusiasts who find difficulty in defining their own needs, to say nothing of the special requirements for other kinds of traffic. If there is not close co-operation among all the factors desiring to use the road inequitable conditions will be provided, and there will inevitably be great waste of public money before the surface can be made suitable for all classes of vehicles. The tendency to-day is to build good roads for light traffic, for touring cars. Will such roads serve for motor wagon transportation?

The era of extensive rural motor haulage is not so distant as may be imagined. In the West, where towns and cities are far apart and rail transportation is costly and scarce, there are innumerable signs that only the surface is needed to develop a marvelous traffic. Scarcely a day passes without the announcement of some enterprise for the carrying of goods or passengers. From these humble and obscure undertakings a great industrial growth will issue in which the state of the highway will play the most conspicuous part. Motor stage lines, often 50, 100 and even 150 miles in length, are being established with such frequency as to denote the great need which exists for freighting development. It may easily be conceived that within the life of the mass of men now living the great volume of the agricultural produce of the country will be moved long distances by means of mechanical road transport. Given suitable highways this miracle would speedily be accomplished.

The federal good roads department states that the direct saving to the farmers from properly constructed roads would be $250,000,000 annually; that there would be a saving of over $10,000,000 in marketing the wheat crop alone, of over $12,000,000 in marketing the corn crop, and of $5,000,000 in marketing the cotton crop. As a rule the farmers are more wide-awake to the necessity of good roads than the residents in cities, as proper highways vitally affect their comfort and prosperity.

* * *

The system now in operation in the state of New York can be commended highly to the inhabitants of all the other states. The state roads are the main traffic lines. They connect the larger centers of population. They comprise 4 per cent of the total mileage of the state, and are to be constructed and maintained directly by the state and at state expense. The county roads form within each county a properly developed system of main market roads, taking into account their use for the purpose of common traffic and travel. These roads comprise about 6 per cent of the total mileage of the state and are constructed under state supervision and at the joint expense of the state, county and town. The town roads comprise the rest of the roads of the state, constituting about 90 per cent of the total mileage. They are built and maintained under the direction of the local authorities, but with state supervision, the cost being borne jointly by the state and town.

TWO-HUNDRED MILE MOTOR STAGE LINE.

MOTOR buses are now crossing the plains between Carlsbad, N. M., and Midland, Tex., via Pearl, Lovington, Knowles and Seminole. Postal matter is carried from Midland to Knowles, and efforts are being made to re-establish mail service between the latter point and Carlsbad.

MOTOR MAIL WAGONS FOR MINNEAPOLIS.

POSTMASTER HALE of Minneapolis recently visited Washington for the purpose of obtaining official consent to the employment of motor wagons in the local mail service. He desires to use two machines in collection work in the outlying districts.

The fire department chief in Allentown, Pa., uses a motor cab in reaching the scene of a conflagration. An alarm indicator placed in the cab company's garage gives warning when the machine is needed.

One hundred state convicts will soon be put to work constructing and improving roads between Pueblo and Colorado Springs, Colo.

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MORE MAIL WAGONS WANTED.

AFTER experimenting for a short time with electric mail wagons New York's postmaster has persuaded the government to authorize the permanent establishment of service north of 42d street. Accordingly bids are required for motor collection and delivery between the stations in the territory named, service to begin July 1 next and continue for four years.

Machines of any kind will be acceptable for the new service, but they must be capable of covering the distances between stations within the time prescribed by the postal department. The successful bidder will be expected to provide drivers and, as occasion may require, increase the capacity of the service.

Ten machines, two with carrying capacity of not less than 4,500 pounds, and eight rated to carry 1,500 pounds, are needed. This is the minimum equipment. In all probability it will be largely increased before the contract expires. A bond of $65,000 will be required for faithful performance of duty.

"It has not taken long to convince me that the delivery of mails by automobiles in parts of the city not reached by our pneumatic tube system gives the best possible service," says Postmaster Morgan. "There has not been a hitch in the motor service since it was inaugurated at midnight on April 14. Thirty-two trips were made between the College point, M, and the Washington bridge stations the first day, and the service has been kept up regularly ever since. An extension of the service is to be made to station J at Eighth avenue and 124th street, from which point connection can be made by pneumatic tube with the Grand Central station and the general postoffice."

The Motor Delivery Company secured the contract for carrying the mails between College, M, and Washington bridge stations. Four electric machines, manufactured by the General Vehicle Company, of Long Island City, are used in this service. The machines are of the latest design. Each has a carrying capacity of 1,000 pounds and will operate forty miles on one charge of battery at a speed of eleven miles an hour on level roads.

During the winter holiday season the Motor Delivery Company has contracted to furnish the necessary number of machines to handle the enormous mails that mark that period. At Christmas time the company is prepared to put into service a score of machines, each having a capacity of forty bags, which is the capacity of the machines now being used.

[As we go to press word comes that the contract, valued at $44,850 a year, has been awarded to the Motor Delivery Company.]

The team drivers' union in San Antonio, Tex., has appealed to the state branch of the Federation of Labor for aid in checking the popularity of motor cabs, alleging that the operators of the machines are "trying to put hackmen out of business." It is suggested that all union men refrain from patronizing motor cabs. Here we have pathos and bathos.

MOTORS VS. HORSES IN FIRE WORK.

A GOOD horse-drawn chemical wagon costs about $2,500, being equipped with two 50-gallon tanks and a single reel of hose. Horses suitable for this work cost about $300 apiece, and where the chemical has to answer all alarms it is necessary to have two spare horses, bringing the total cost for horses alone up to about $1,200. The harness equipment, blankets, etc., costs in the neighborhood of $500 to $800, making a total cost of from $4,200 to $4,500 for the initial cost of the horse-drawn chemical.

In comparing this outfit with the motor hose and chemical wagon it must be remembered that the machine can be quartered in about one-third of the space required for the horse-drawn equipment.

The up-keep cost of two horses alone, including harness repairing, shoeing, etc., is at least $350 a year, and if we consider a four-horse outfit, which certainly would be necessary if any kind of efficiency were to be obtained, an outlay of $700 a year would be required. The up-keep of the wagon itself would probably vary from $50 to $100 a year under normal conditions, making a total of at least $400 a year, and nearly $800 if four-horse equipment was used. Added to this cost is the very serious item of replacement of the horses at very frequent intervals. The best horses cannot stand chemical work for much over two years. They cost, as already stated, $300 apiece, and the department considers itself fortunate if it can get $50 for them at the end of two years' service, and this in spite of the fact that the horses are well taken care of and plenty of spares are provided. For an efficient horse-drawn chemical service, therefore, there must be added to the cost of up-keep practically a new horse every year, or at least $200 or $300 on this single item.

To get a fair estimate of the up-keep cost of a motor chemical, one can quote the exact figures for maintaining the Bridgeport machine from January, 1908, to January, 1909. During this period the total cost of up-keep amounted to a trifle over $250, outside of the supplies for the chemical fire-fighting apparatus, or $276.18 including all supplies. This expense was distributed up as follows:

Tire chains to prevent skidding	$ 22.00
Gasoline	57.00
Oil	37.70
Tires, including tire repairs	64.25
All repairs on machine, except tires	51.78
Ignition, apparatus repairs	16.20
Batteries	1.50
Total	$250.43

The minimum gasoline cost was $2.20 during the month of December, and the maximum $12.60 during the month of March.

The Bridgeport motor chemical was driven, during twelve months, approximately 1,400 miles, although only 800 miles of this was in fire service, the remainder having been used in demonstrating and to get the men familiar with the machine.

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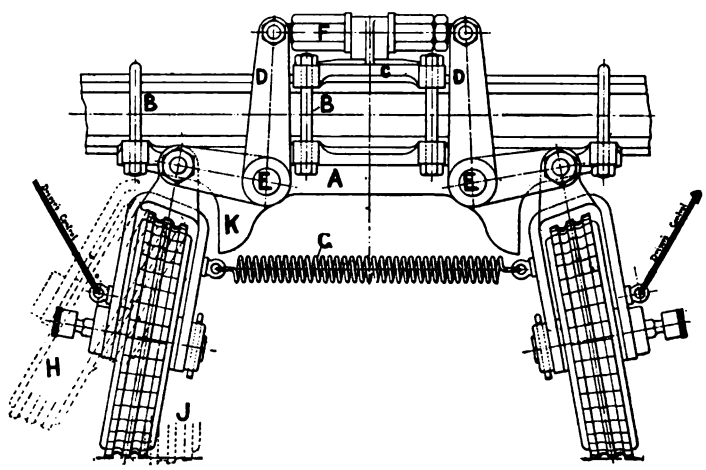
DEVICE FOR PREVENTION OF SIDE SLIP.

MANY devices have come to light within the past few years for the prevention of side slip on heavy commercial motor vehicles. Thus far, however, the majority have either proven too costly in construction or too complicated in mechanism to supersede either the chain wrapped rear tire or the chain imbedded between the twin tire sections of rear wheels; and hence these latter preventive forms continue to hold their own, despite their manifest shortcomings and the destructive effect of their action upon the road surface.

The device shown in the accompanying illustration is said to be very effective. It consists of two inclined



wheels suspended from the rear axle and shod with vulcanized fiber blocks. The theory of its application is as follows:

As the vehicle evinces a tendency to slip sidewise either of the two wheels of the auxiliary device will offer resistance, acting as a wedge, and effectively check the untoward progress of the vehicle. In its primary form the wheels of the device were fitted with rubber and failed to give good service results, the rubber wearing rapidly and causing a greater inclination of the auxiliary wheels than was originally intended.

The construction is as follows: A large sole plate (A) is, by means of the strap bolts (B) and the saddle plate (C), secured to the rear axle of the vehicle, and on the sole plates two pairs of bell cranks (D, D) are pivoted at the points (E, E); as can be seen in the illustration, the wheels are suspended from the outer ends of the smaller arms of the bell cranks, and the vertical arms are connected together by means of the adjusting screw (F), which is provided with right-hand and left-hand threads, in order to draw these levers close together, or to thrust them farther apart, as the condition of the tire demands. The forked frames, when the device is in action, are normally drawn together by means of the helical spring (G). This device, of course, is only brought into operation when the surface of the road necessitates its use. On dry days, or when the road surfaces are clean and there is no tendency to side-slip, the forked frames, with their wheels, may be withdrawn from contact with the road, by means of the steel cables, the ends of which cables are shown attached to the forked frames; the wheels will then assume the position shown dotted at H. When the surface of the road resists the sideways motion of either of the wheels, there is a tendency for it to assume a vertical position, as shown dotted at J; the consequent wedging action increases the intensity of pressure between the wheel and the ground, and the sidewise motion of the vehicle is arrested.

In order to prevent the wheel from moving beyond the vertical position, and thus becoming inclined in the opposite direction, there are two lugs (K) projecting from the sole plate, and these act as positive stops to the forked frames.

TREND OF CAB ENGINE DESIGN.

EXPERIENCE shows that the relatively high power four-cylinder engines with which cabs both here and abroad are chiefly fitted, do not tend to provide low expense for fuel or tires. The potential speed of the machines is too high, there is too great reserve of power under normal working conditions, and there is a strong disinclination among cab purchasers to pay for design or construction which is seldom if ever required in service.

French cab designers now evince a decided preference for the two-cylinder, low-powered engine. The four-cylinder, high-powered engine still survives, but its employment is rapidly being abandoned by all the prominent city cab owners. It is principally used in distant service, where more than three passengers have to be transported. The single-cylinder engine, too, is coming into use. "Monos" is the term applied to vehicles so equipped. They develop 8-10 hp.

MOTOR KITCHENS.

TRIAL of the motor kitchen is to be made simultaneously in Berlin, Paris and Moscow. The novelty of the enterprise will probably secure it a deal of gratuitous advertising, and if street operations are kept within reasonable bounds it is not improbable that the venture will prove successful. Everyone is familiar with the horse-drawn kitchen, which emerges from some alley when night falls and is drawn by its skeleton horse to a few advantageous points where custom may be sought. The motor kitchen is to be equipped in a very superior manner and, while circulating only in the poorer and outlying districts, is quite likely to be favored with a volume of patronage not now accorded to its humbler and less active forerunner.

The national government has been petitioned to sanction the establishment of a motor mail route between Guymon, Okla., and Clayton, N. M. Points on the way are Gable, Dilya and Boise City.

The Auto Cab Company of Youngstown, Ohio, has been formed with capital stock of $15,000.

The Auto Transfer Company has been organized in Michigan City, Ind.

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CAB MERGER IN CHICAGO

CONSOLIDATION of four motor cab companies has taken place in Chicago. The merged concerns are the Canary, the Coey, the Kenwood and the Chicago companies.

The capital stock of the new company is $2,000,000. Its title is the Chicago Taxicab Company. It was underwritten by W. W. Tracey, head of the brokerage house which failed last month with liabilities in excess of $1,000,000.

There are several strong concerns outside of the combination, notably the Walden Shaw Company, which operates 45 machines, and the City Motor Cab Company, which recently entered the field and proposes to operate 100 machines.

The principal men connected with the new company are: W. C. Brown, president of the New York Central Railway; F. W. Upham, president of the City Fuel Company; John R. Thompson, county treasurer; E. T. Glennon, of the Lake Shore & Michigan Southern Railway; Adam Ortseifen, Job L. Kesner and Alderman McCoid.

It is said that the new company controls 65 per cent of the local motor cab traffic. Two hundred new machines are to be put on the streets, which will bring the total equipment up to 300. It is the intention to build garages in four sections of the city in order to reduce the non-paying mileage.

LOW FARE CAB SERVICE.

WITH an equipment of 100 machines, which it is expected will be increased to 1,000 by the end of the year, the Metropolitan Taxicab Company proposes to furnish low fare service in New York. The rates are to be as follows:

First half mile .....20 cents
Each additional half mile .....15 cents

The company proposes to establish eight stations between Fulton street and Harlem, one every mile. Philip Daab, a member of the New Jersey legislature, is president. The concern is capitalized at $200,000. F. S. Thomas is treasurer, and E. S. Drinkwater secretary.

The manager of the company, Frederick Wellman, says:

"We intend to reduce the non-running expenses by having eight stations on the route from Fulton street and Broadway to 125th street. When a cab is discharged uptown, the driver will go to the nearest station and report. These stations will be at Fulton, Desbrosses, Twenty-third, Thirty-fourth, Forty-second, Sixtieth, Ninetieth and 125th streets. The main garage of the company, which is nearly completed, will be in West Sixtieth street, near Eighth avenue."

The Newark (N. J.) hospital for contagious diseases is to be supplied with a motor ambulance.

It is expected that motor bus service will be furnished between Rome and Adairsville, Ga., which are 18 miles apart.

MOTOR CAB EARNINGS.

EARNINGS of the machines operated by the General Motor Cab Company, of London, are now regularly published. The following table shows the receipts for a late period:

Week ending April 3.....$71,212.80
Week ending April 10..... 67,747.20
Week ending April 17..... 62,220.40
Week ending April 24..... 79,593.60
Week ending May 1..... 77,347.20
Week ending May 8..... 82,886.40

In providing this information, however, the company does not inform us how many machines were at work during the period under consideration, and consequently the figures presented are only mildly representative of the actual state of its business.

MOTOR CAB RATES OFFICIALLY FIXED.

WASHINGTON is the first city in the country to fix motor cab rates by law. The commissioners of the District, after many conferences with machine owners, have officially sanctioned the following tariffs:

TARIFF NO. 1—FOR ONE OF TWO PERSONS.

For the first half mile, or fraction thereof.....30 cents
Each quarter mile thereafter .....10 cents
Each six minutes of waiting.....10 cents

TARIFF NO. 2—FOR THREE OR MORE PERSONS.

For the first third mile, or fraction thereof.....30 cents
Each sixth of a mile thereafter.....10 cents
Each six minutes of waiting.....20 cents
Rate per mile, or fraction thereof, for cabs traveling empty outside of the two-mile radius.....20 cents
Carrying one trunk .....20 cents

No charge shall be made for handbags or suit cases carried inside the cab (not more than two to each passenger), or for children under seven years of age. Additional baggage, for each piece, 20 cents.

These tariffs are to apply to day and night service. City service tariffs are to apply only to distances of more than a mile. The minimum price for city service for a mile or fraction thereof is 50 cents. No charge is to be made for going to or returning from any point within two miles of the garage from which the cab is ordered when such distance is traveled without passengers. Within this radius the meter shall not begin to register until the cab has been entered by its passenger. The distance traversed by the empty cab outside of the two-mile radius shall be paid for at the prescribed tariff.

Tariff No. 1 and Tariff No. 2 are for city service.

Distances beyond the two-mile limit are to be charged for at the rates prescribed in the tariff. Within the radius of two miles the meter shall not begin to register until the cab has been entered by its passengers. Service from any point within two miles of any garage to any theater and return shall be not more than $3 for one or two persons, nor more than $4 for three, four, or five persons.

During the month of April 10 motor trucks and 51 motor cabs were imported from Europe.

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DEFECTS OF GASOLIEN BUSES.

EXCESSIVE weight and undue noise in operation after comparatively short use are pointed out by the London police authorities as two of the principal defects in gasoline bus construction of the present day.

In the opinion of the police commissioner it is practicable, by sacrificing a small proportion of the present carrying capacity, to place upon the streets buses considerably lighter, and therefore not liable to produce the vibration which the residents of streets find so damaging to their household property, and which, by reason of greater lightness, will lessen the causes of the noise which has so long been a source of great discomfort to all users of the streets. He is advised that the weight of these vehicles should not exceed 3½ tons, and that within this limit it is practicable to produce a vehicle capable of carrying not less than twenty-six persons. Proprietors and all others concerned are notified that in future no motor bus will be licensed which exceeds this weight.

Special consideration will continue to be shown to vehicles now licensed, it being understood that they will not be re-licensed unless the noise they make is reduced and obvious defects remedied. As much of the noise made by these machines arises from the unsatisfactory condition of their working parts, the defective state in which these are often found when a breakdown occurs in the streets will be regarded as evidence of negligence of maintenance and unfitness for service.

NEW YORK'S CAB ORDINANCE.

THE attempt to regulate the charges for motor cab service in New York by means of municipal legislation has thus far proved abortive. An ordinance was drafted providing fixed fares for two species of small public service motor vehicles, one described as a taxicab and the other as a taxicoach. In this measure it was proposed that the service of the former be charged for at the rate of 25 cents for the first half mile, or any part thereof, and 10 cents for each succeeding quarter of a mile, with a waiting time rate of 60 cents an hour. The taxicoach rate was to be 50 cents for a half mile, or any part thereof, 10 cents for each succeeding quarter of a mile, and 60 cents an hour for waiting time.

The taxicab was designated as a machine to seat two persons, and the taxicoach as a machine to seat more than that number. It was further designed that machines serving hotels were to pay a license fee of $10, public taxicabs a fee of $8, and public taxicoaches a fee of $12, while a special taxicoach was not to be licensed for less than $15. In addition to this the driver of the taxicab was to pay a license fee of $3. A further provision of the ordinance was the establishment of 15 inspectors of cabs and meters, whose services was to be maintained at an annual cost of about $25,000 per year.

The firms having investments in motor cabs protested so strongly against the proposed reduction of fares that they succeeded in having this feature of the ordinance stricken out. Fifteen inspectors will be appointed to look after motor cab recording instruments.

MOTOR BUS PROSPECTS IN BERLIN.

RESULTS are not tantamount to experience. This sententious observation is made by a prominent engineer in reviewing the history of motor bus traffic in Berlin. Its appositeness to the whole subject of commercial motor road transport is so apparent that it is impossible to refrain from featuring it.

In a general defense of the motor bus situation this far-seeing authority remarks that right eventually will be found upon the side of those who contend that the big public service machine has a brilliant future. Administrative and engineering errors of the past must be condoned and overlooked, and attention fixed exclusively upon the field, development and proper application of the machine. It is pointed out that the failure and dissolution of a few motor bus undertakings does not afford condemnatory proof of a general nature against all such enterprises. Many fixed rail undertakings have failed to yield a profit in the beginning of their existence. Some have even been abandoned. But railroad building and investment are not stopped because of these misfortunes. A few years ago Prussia had 138 street car systems, 18 of which paid no dividend, 30 yielded between 1 and 3 per cent, and only 7 as much as 4 per cent.

The opinion is ventured that in the future motor bus fares will be lower than at present, while street car fares will be higher. Working expenses for fixed rail transportation are increasing, whereas the cost of operating motor buses is rapidly being decreased. In summing up it is declared that under carefully selected conditions motor bus traffic not only pays handsomely, but is actually greatly superior to any other form of transportation.

AMENDED MOTOR BUS MEASURE.

THE Pennsylvania senate bill affecting motor bus operation, sketched in the last issue of this paper, has been amended so as to permit machines to travel for a distance of but four blocks on streets used by trolley cars.

Encouraged by a petition signed by nearly all the heavy taxpayers, the city council of Lewiston, Idaho, has authorized the purchase of a motor hose and chemical wagon at a cost of $5,370.

Four hundred men will begin grading on the new 500-mile boulevard between Valdez and Fairbanks, Alaska, as soon as the snow disappears. It is expected that within two years it will be possible to use motor wagons the year around.

Motor buses are to be used in the Yukon pass, Alaska.

Money is being subscribed for a company to operate motor buses between Balboa and Santa Ana, Cal. Hourly trips are to be made.

Pueblo, Colo., is experimenting with the motor cab.

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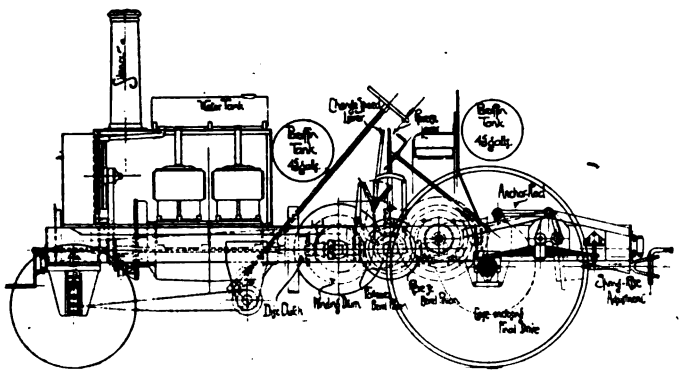
TEST OF MILITARY TRACTORS.

A SHORT time ago the British war department conducted motor tractor trials, lasting ten days, having previously agreed to purchase the successful machine, and award a prize of $3,750 to its makers. Selection was made of a paraffin engined Thornycroft tractor, costing $4,875, fitted with a winding drum.

It was frequently demonstrated during the trials that eight-ton loads could be hauled through marshy ground by



The Thornycroft military tractor.

means of the winding drum. Without load the winning vehicle easily traversed all bogs encountered, although often mired to the wheel hubs.

The practical results of these tests are worth noting. It was shown that this class of machine can travel 100 miles without taking on fresh supplies; that it has power to pull a heavily loaded trailer through sand, soft ground or marsh; that its large diameter and wide wheels do not impair existing road surfaces; and that it can readily haul six or seven tons behind the draw bar on roads of any kind.

Doyal and Susanville, Calif., 50 miles apart, are to be connected by motor bus.

Motor buses are to be operated between Manitowoc and Silver Lake, Wis.

MILITARY TRANSPORT WASTE.

DURING the late South African war the prodigious sum of $175,000,000 was spent by Great Britain for the purchase of cavalry remounts and the hire of animal transport. The little of mechanical transport which was witnessed in the course of that costly struggle fully confirmed its advantages, and is made use of to-day in pressing its more extended adoption for military operations.

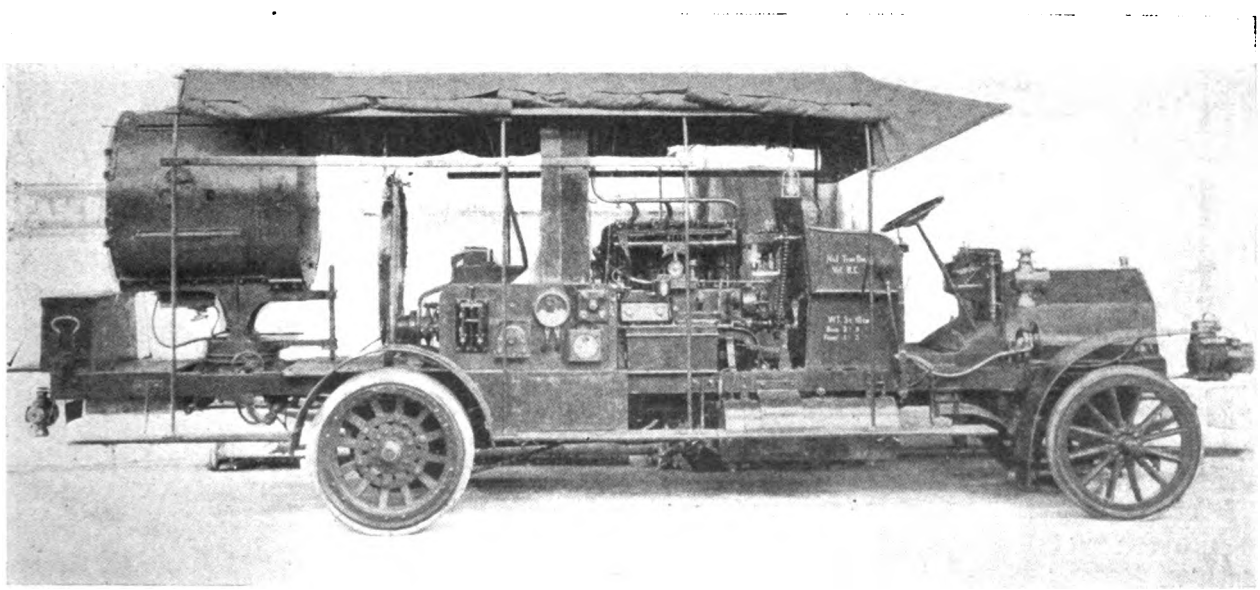
Judging from the active manner in which foreign war ministries are encouraging the design of military road tractors, trains, trucks and wagons, it seems likely that the transport sections of all armies will soon be less wastefully conducted than at present. Even if there was no proof of the machine's superiority in field service, an assumption which is far from tenable, it would appear to be good policy to profit by their employment in times of peace. The pacific work of army transport animals, hauling ordnance, ammunition and food supplies, is as amazing in its costliness as it is inefficient.

Nine motor buses, owned by the state of Bavaria, carried 281,177 passengers during the past season, the receipts amounting to $62,812. Their operation has been decidedly profitable, a balance of about $17,500 lying to the credit of the enterprise. Trailers are sometimes attached to the machines.

None of the New York motor cab companies now provide bail when their drivers are arrested for overspeeding.

Minneapolis will be provided with motor cab service on July 1. The machines will be operated by the Pence Taxicab Company, capitalized at $75,000. A feature of the garage will be a stonewood floor, made in Germany, which has a cork base.

All motor funeral processions were recently witnessed in Philadelphia and Scranton.



Military vehicle equipped with powerful field searchlight coupled to multipolar dynamo generating current for arc light used. The engine develops 45 hp.

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GENERAL MOTOR TRANSPORT.

THE Worthington Transportation Company, of Worthington, Mass., is the title of a concern recently organized with capital of $10,000 to operate commercial motor vehicles for the transport of freight and passengers. The company's machines will at first ply between Worthington and Huntington, which are 15 miles apart. Good country roads, although somewhat hilly, connect the two points. Going north, the route is up grade; returning, it is down grade nearly all the way. The operating season begins June 1 and it is expected will end October 15.

Should this line prove successful the company will operate three others in the same neighborhood. The men behind the enterprise are prepared to contribute liberally toward the maintenance or establishment of good roads, expecting in return that the towns they furnish with service will not shirk their obligations. The company's machines have capacity for 18 passengers.

MOTOR ROAD DRAGS.

ROAD dragging in the future will unquestionably be accomplished by motors. Even the farmers, upon whose horses such work now entirely devolves, realize this, and are advocating a policy which will compel automobile owners to assume an obligation which they can very conveniently perform. One of them makes this practical suggestion:

"Let each man who owns a machine work five miles of road in a certain township and take a receipt from the township road overseer, and it will be only a short time until we have good roads all over the county. Any motor car of any power can haul a road drag, and this appears to me to be one of the simplest, easiest and least expensive methods of making good roads."

STREET CLEANING ECONOMY.

MECHANICALLY operated street washers are used with much economy in Berlin. The machines, several of which are employed, are electrically propelled. They have been in service since the end of 1907.

One of these machines will clean 5,000 square meters per hour. For a working day of 8 hours the cost of operation is as follows: driver, 5 marks; cost of current for the batteries, 2.20 marks; charge of batteries per annum, 800 marks, or, reckoning 300 days, per day, 2.67 marks; one rubber brush per annum, 500 marks, or, per day, approximately, 1.67 marks; depreciation for one day at 12½ per cent per annum, approximately, 5.20 marks—total, 16.74 marks. A horse drawn vehicle costs 20.50 marks per day.

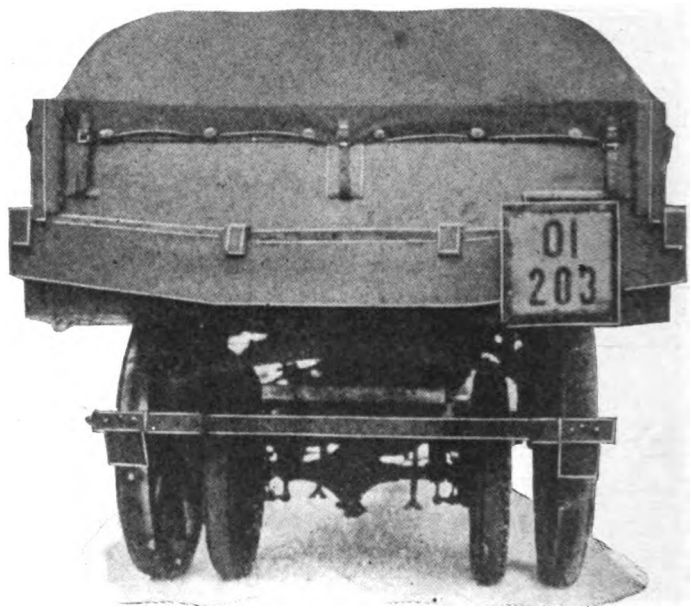
A company with capital of $25,000 is being formed to operate a motor bus line between Reidsville and Spray, N. C.

It is expected that motor bus service will soon be established between Quincy, Ill., and Siloam Springs, the waters of which are famed for their curative properties.

NEW PRINCIPLE IN DESIGN.

IN THE construction of a German motor wagon a new principle of design has made its appearance, the mechanism for driving being independent of the carrying structure.

The wheels of the driving vehicle are mounted on pneumatic tires. No more of the useful load rests on its chassis than is necessary for adhesion, which is about one-fifth of the weight. The load carrier is detachable. Its two steel-shod wheels run alongside and outside the two rear pneumatic tired wheels of the chassis.



Independent load carrier in position.

Tne carrier.

The load carrier is attached to the chassis by means of an adjustable coil spring and front supports. By shifting these supports the pressure on the rear wheels of the chassis may be varied. When it is necessary to balance the load the carrier platform can be slid backwards or forwards. There are no side stresses on the pneumatic tires, they being relieved by the employment of the carrier steel wheels.

Two electric police patrol wagons have been ordered for duty in Rochester, N. Y.

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PROPOSED FUEL TAX.

THE taxation of commercial motor vehicle fuel is being considered by the British government, the proceeds to be used in improving the rural highways. It is also proposed that the fuel of pleasure cars shall be taxed, the former at 3 cents for every gallon consumed, and the latter at 6 cents a gallon.

In the event of the measure becoming a law the London motor bus companies, as at present equipped, will find it necessary to pay about $177,500 annually, and strong protest is heard in that quarter against the inequitable conditions of the tax, especially as such machines do not use the country roads. It has also been calculated that the increased cost per mile of operating other types of commercial motor vehicles would be about as follows, if the tax is imposed: one-ton wagon, annual mileage, 20,000, .225 cent; two-ton wagon, annual mileage 18,000, .30 cent; three-ton wagon, annual mileage 16,000, .46 cent.

CHALFANT JOINS THE PACKARD FORCES.

EDWARD P. CHALFANT has resigned as manager of the Association of Licensed Automobile Manufacturers to join the forces of the Packard Motor Car Company, of Detroit. He will occupy his new position about June 1. This is the second time that a manager of the A. L. A. M. has retired from that body to become associated with the Packard company. Mr. Chalfant will be located at the factory in Detroit, where he will assist General Manager S. D. Waldon and President H. B. Joy in the executive work of the company. For several years prior to his connection with the A. L. A. M. he was sales manager of the Waltham Mfg. Co.

TO MANUFACTURE IN WORCHESTER.

ALL plans have been completed for the manufacture of the Morgan 4-ton gasoline truck in Worcester, Mass. This machine was thoroughly described in the January issue of this journal. The manufacture will be carried on in the disused Crompton-Thayer loom works. An abundance of capital has been secured for the undertaking.

TO PRODUCE TRUCKS IN MINNEAPOLIS.

THE Minneapolis Motor and Truck Company has been formed to manufacture motor trucks. The capital is $500,000. M. A. Gerber is president and treasurer, W. B. Murray vice-president and Frank Healy secretary.

The postal officials are considering the use of motor wagons in and around Hoboken, N. J. At present an unusually high price is charged for the service of trolley cars, which transport mail from the central postoffice to branch stations.

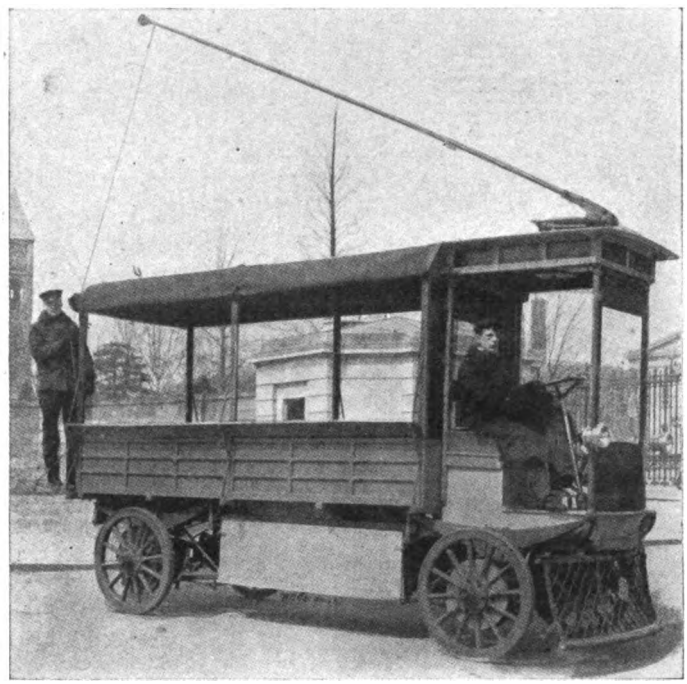
Three motor railway station buses have been purchased as equipment for the Swarthmore Service Company, operating in one of Philadelphia's suburbs. The machines are used for the convenience of Swarthmore residents.

Motor bus service is being supplied between Quincy and Plainville, Ill.

TROLLEY WAGON.

THE accompanying picture shows a trolley wagon built in Philadelphia. Whenever the machine is denied the use of the railway tracks or overhead wire its storage battery equipment comes into play. All four wheels of the vehicle are fitted with motors, each wheel being a driver.

The motors are connected in series when the trolley current is used, and in parallel when connected with the



Trolley Wagon made in Philadelphia.

battery, which consists of 40 cells. The battery is automatically charged when the vehicle is running on the trolley circuit. The wheels are 36 x 3 inches, fitted with steel tires.

Efforts are being made to operate machines of this type in Pittsburg and other cities.

The sum of $14,000 will be spent by the authorities of Trenton, N. J., in the purchase of two motor driven fire vehicles.

It is interesting to learn the big Selfridge dry goods establishment in London, presided over by a man who made his mark in the commercial world as general manager of Chicago's largest firm of the kind, makes free use of light motor wagons and intends to employ a very extensive fleet of both light and heavy machines.

A farmer residing near Stratford, N. D., hauls his grain to market by motor. The machine pulls a train of ten wagons. The journey requires half a day.

Many motor cabs in Berlin are owned by their drivers, having been purchased on the installment plan. The first payment amounts to $350, the succeeding monthly payments being $115. The machines are guaranteed for six months. Most of the machines are fitted with two cylinder 12-14 h. p. engines.

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USEFUL MOTOR FIRE VEHICLE.

MOTOR hose and chemical wagons are being purchased with considerable freedom by municipalities whose authorities realize the inadequacy of horse drawn fire vehicle service in protecting outlying property.

There are more than 150 such machines now in use in minor cities and towns throughout the country, and the number is increasing steadily as their superior range, efficiency and economy is being made known to fire department officials. In large cities, too, they are being adopted, although not so readily as in the small places. This is owing to the fact that in big cities the present form of fire service is highly organized. In the rural sections, on the other hand, the equipment is often obsolete. It is no exaggeration to say that a majority of the small cities throughout the country, more especially in the eastern manufacturing region, desire the protection of motor driven fire vehicles, and only a shortage of municipal funds prevents their immediate purchase.

Last month Bristol, Conn., was supplied with one of these machines by the Pope Hartford Company. It is equipped with a 40-hp. engine, 34x5 inch tires, a 40 gallon chemical, with extra jar and holder, and connection for 2½ inch water hose. The metal hose basket contains 250 feet of ¾-inch hose, and the body has a capacity for 1,000 feet of 2½-inch hose. There are two 15-foot ladders, two 3-gallon hand extinguishers, two pickhead fire axes, several firemen's lanterns, a door crowbar, and a 13-inch gong.

The machine can attain a speed of 50 miles an hour, although 35 miles is considered the normal rate of travel. The wheel base is 118 inches. The selective type of gear transmission is employed. When on duty the machine carries from eight to ten men.

In discussing the practicability of the machine one of the officials says: "The extension ladders carried will enable the firemen to readily get into a second story window if necessary and with the other equipment will often enable the crew to control and extinguish a fire without calling out the entire department. This will result in a saving of money for the town."

The machine cost $4,000. Its use became imperative once the hills about the town were selected as residence sites, the water pressure at the heights being insufficient without the use of the auxiliary power which a speedy motor hose and chemical wagon supplies. The hills, too, seriously impair the effectiveness of horse-drawn fire equipment of any kind.

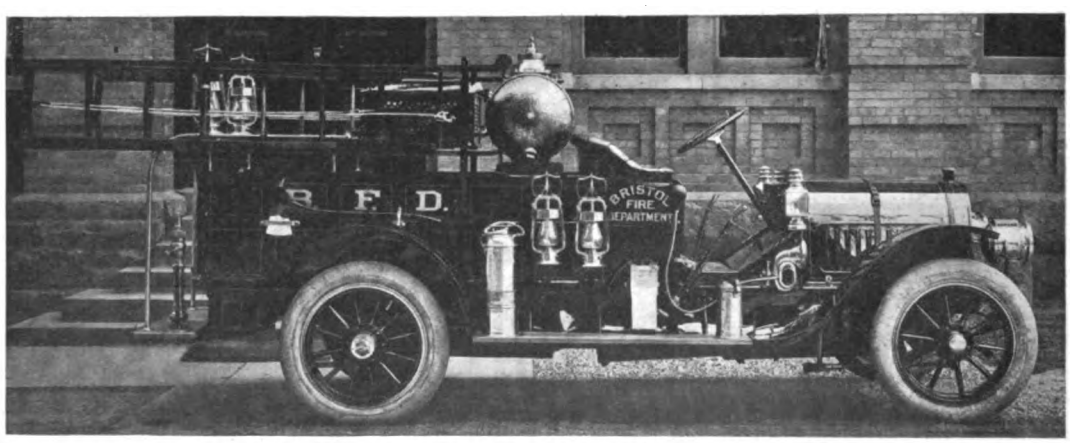
NEW CHICAGO HOME FOR STUDEBAKER CO.

THE Studebaker company is erecting, at the corner of Michigan avenue and Twenty-first street, in Chicago, what will undoubtedly be one of the most elaborate and

best equipped automobile salesrooms and garages in the country. The building will be ready for occupancy about January 1, 1910.

Motor bus service is to be provided between Greenspring, Tiffin, Clyde and Fremont, Ohio. Later the line may be extended so as to serve Fort Clinton and Sandusky.

The thirty-five miles separating Thermopolis and Shoshoni, Wyo., are to be traversed by motor bus.



Motor hose and chemical wagon installed in Bristol, Conn. Built by the Pope-Hartford Co.

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Blue Ridge and Melissa, in Texas, are now connected by motor bus. As that section of the country is without railroad service of any kind, the road machines are accounted a great convenience by the inhabitants.

Last winter the Berlin authorities experimented with a specially equipped motor wagon for the removal of snow from the streets. The snow was first shoveled into horse drawn wagons, from which it was emptied into the large body of a machine that transported it to the dumping ground.

The minister of communications is considering the employment of motor wagons for the transportation of mail in the principal cities of Japan. It is expected that machines will be purchased at once for use in Tokyo and Osaka. If the government consents to their use the 50% import tariff on them will be remitted.

The longest motor postal route in existence is that between Bagdad and Aleppo in India. The distance is 625 miles. The journey requires 60 hours. Formerly mail was transported by camels.

The purchase of two motor hose and chemical wagons has been recommended by the fire department of Newburyport, Mass.

Motor bus service is to be supplied between Bangor and Easton, Pa. The company is capitalized at $10,000.

The streets of Stockton, Calif., were recently flooded by a heavy rainfall, and business was at a stand still until the flood abated. The water in cellars was removed by means of hastily arranged pumping devices attached to motor vehicles of all kinds. One business house used this auxiliary power for the operation of a sausage grinding machine.

Baggage and passengers will be carried in motor buses which are to operate between Millbrook and Poughkeepsie, N. Y.

The sum of $5,000 has been appropriated for the purchase of a motor ambulance for St. Louis. The annual maintenance charge of the machine is covered by a further appropriation of $1,500. It is expected that the machine will perform the work of three or four horse drawn vehicles.

Motor buses are operating between Issaquah and Renton, Wash.

Buffalo has 340 miles of asphalted streets.

Electric cabs are operating in Huntington, W. Va.

A company is being formed for the operation of motor cabs in Halifax, N. S.

Motor cab service is to be established in Nashville, Tenn., by a company which is capitalized at $30,000.

The postmaster of Buffalo expects soon to be authorized by the Washington authorities to use motor wagons in mail collection service.

A German concern manufacturing motor lorries, despite the prevailing dullness in foreign commercial circles, cleared a net profit of $56,715 as a result of its trading in 1908.

Steam patrol wagon owned by city of Rio de Janeiro.

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The Detroit Taxicab Company has made an arrangement with the Detroit Omnibus Lines Company whereby the latter concern will be provided with 75 motor cabs for transferring passengers between railroad stations and steamboat landings.

The Chattanooga (Tenn.) Taxicab Company has been formed with capital stock of $10,000.

The Pittsburg Taxicab Company has commenced service with 20 machines.

Sunday mail collections from the suburbs of Indianapolis are now being made by motor vehicles. Only seven men are detailed for this form of Sunday duty. When horse drawn vehicles were employed it was necessary to retain the service of 16 men.

A 4-ton motor truck is operating between Rock Springs and Pinedale, Wyo., 120 miles apart. The trip is being made in 10 hours. Hauling the same load horses require 10 days for the journey.

The merchants and residents of Metuchen and South Plainfield, N. J., having failed to establish trolley line service between the two points, have decided to connect them by means of motor bus. Most of the territory to be traversed by the machines is rich in revolutionary history.

A French firm has produced a machine which is fitted with a steel disinfecting oven carried on a specially constructed platform. The oven is mounted on runners and is readily removable. It disinfects linen.

Joplin, Mo., pays $50 a month for the use of a motor police wagon. The city, however, does not exercise any right of ownership in the machine, which is maintained by a private company that furnishes a driver and keeps it in order.

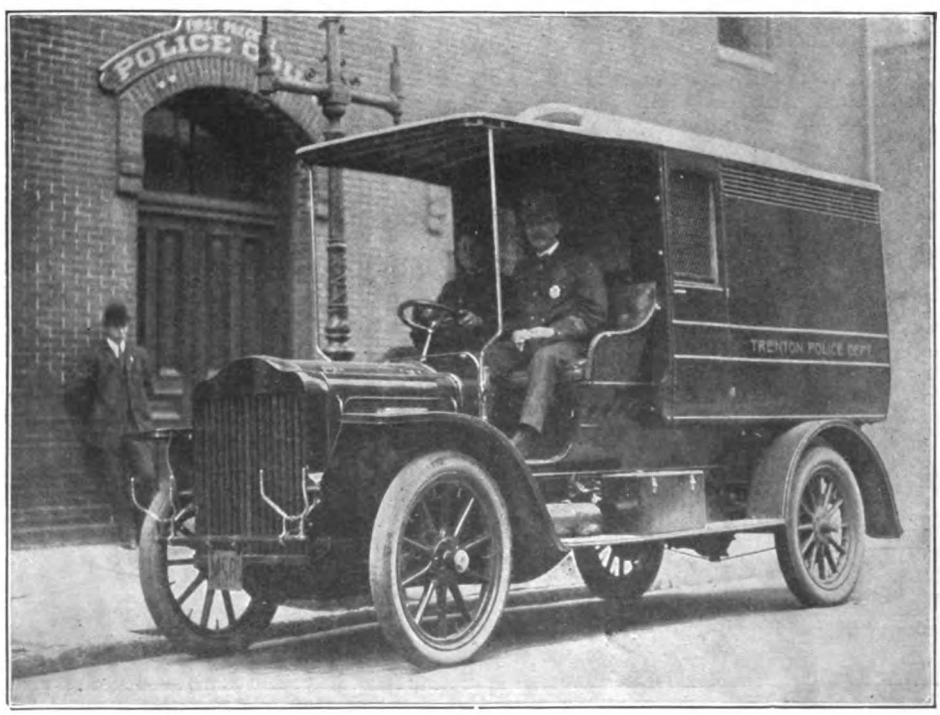
For the benefit of railroad operatives living in Massillon, O., and employed in Brewster, a motor bus service is to be operated. The round trip fare is to be 30 cents.

For the first three months of the present year the New York police records show that 434 accidents were chargeable to vehicles. Of this number 162 were caused by street cars, 167 by horse drawn vehicles, 90 by automobiles, and 15 by railroad trains.

After colliding with a trolley car in Brooklyn, N. Y., a taxicab hurdled a stone wall surrounding a fountain and spilled its six passengers into the water.

The Terminal Taxicab Company, of Washington, D. C., is defendant in a suit for $10,000 damages, instituted by a passenger who was injured as a result of the vehicle colliding with a horse drawn wagon. Negligence in operating the machine is the basis of the suit.

A company has been organized to operate motor buses between Paso Robles and Coalinga, Cal., through the Cholame Valley, a distance of 80 miles. The service will reduce by 24 hours the time now required in making a journey from Fresno to Santa Barbara, Paso Robles, Salinas and other points on the coast line railroad. The trip will be made in 4½ hours.



Steam ambulance and patrol wagon used by Trenton (N. J.) police.

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The Power Wagon

A Journal for Those Employing Commercial Motor Vehicles

No. 56 JULY, 1909 No. 56

PUBLISHED THE FIRST OF EVERY MONTH BY

THE POWER WAGON PUBLISHING CO.

SUBSCRIPTION RATES:

One Year (Domestic)	$2.00
One Year (Foreign)	3.00
Single Copies	.20

PUBLICATION OFFICES:
THE METROPOLITAN BLOCK
Chicago, Illinois.

Advertising Rates on Application

WALTER WARDROP, Editor

Entered as Second-Class Matter December 2, 1907, at the Postoffice at Chicago, Ill., Under the Act of Congress on March 3, 1879.

The Maintenance Contract

An Alternative Policy Devised for Those Who Are Unwilling to Assume the Burden of Administration

APPARENTLY the maintenance contract has come to be regarded as an essential part of the policy which governs the sale of commercial motor vehicles. Primarily designed to overcome the timidity of establishments which desire to profit by mechanical road haulage, but lack the courage to assume full responsibility for so novel an undertaking, its employment is now quite extensively approved by firms which cannot be charged with any such shortcomings. A great many concerns are willing to pay a slight premium for a service which they themselves are quite capable of performing. The enormous volume of draft animal transportation which is sublet by mercantile houses furnishes proof of this statement. And perhaps the tradition of this custom has exerted a powerful influence in shaping the trend of affairs in power wagon transportation.

The makers of power wagons have a double purpose in view in urging customers to accept the conditions of the maintenance contract. Wishing to quickly release the product of their factories, they are easily convinced that a ready way of accomplishing this is to assure its economical upkeep in service. Experience has taught them that machines are only well sold when they are well maintained. Hence their willingness to share the burden of administration until such time as they can conveniently be rid of it.

In this situation it is necessary for manufacturers to provide a rather elaborate system for distribution. Agents must act as links between producers and buyers, and acquire the habit of sympathizing with the latter in their hesitation to take advantage of a new means of transportation upon a very brief acquaintance with it. The more remote the factory's customer the greater is the need for the intermediary.

The fault of the maintenance contract as at present executed lies in giving executive control of the drivers to the owners of the vehicles. This arrangement cannot very well be avoided unless owners are willing to make the drivers responsible to the contractors, which would be a subversion of ordinary transportation practice. Under these circumstances it is of interest to consider how the operation of the contract may affect owners of machines and their subordinates. In some instances it has developed that the owners have grown careless as their responsibility has been decreased. There is a decided temptation to employ low paid drivers who, it need scarcely be said, are not very efficient. The spread of such a practice would have the effect of increasing the cost of maintenance and causing loss to the contracting company.

In the opinion of many who have had considerable experience with maintenance contracts it is not advisable to use the same form of agreement in all undertakings. The varying character of service to be performed by the machines has to be considered, as well as the loads, speeds and the nature of the routes traversed. Of course the fixed charge for superintendence will change with the work performed.

* * *

In past issues we have presented a few contract forms which are in general operation. In the hope that its terms will prove enlightening to those who may wish to know more about so important a subject we herewith submit another:

Draft of Letter to Customers of Contracting Company.

Dear Sir—Following are the conditions upon which we shall be prepared to maintain the motor chassis No. .... manufactured by us belonging to you:

Conditions.

on which the ..... company (hereinafter called "the company") agree to maintain and keep in perfect running condition for a period of three years from this date the motor chassis No. ..... manufactured by them and owned by ..... of .... (hereinafter called "the owner"). Such maintenance to consist of a weekly inspection at a garage to be indicated by the company, and the making of all necessary adjustments, repairs, renewal of worn and broken parts—provided such breakages are not due to any accidents, such accidents to include

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bursts and breakages due to frosty weather—also a complete overhaul every half year at the company's works, or elsewhere, if determined by the company, if necessary.

1. The owners shall during the term of this agreement provide a suitable and competent driver, such driver to be in the employ of the owner, but to obey such instructions as the company's inspector may give him with regard to the maintenance and mechanical details of the vehicle, and any adjustments which such inspector considers should be made, and no person other than such competent driver is to be employed as driver of such vehicle.

2. One hour per day must be allowed to the driver in order that he may lubricate the vehicle in the owner's garage and clean it forward of the driver's seat in accordance with the written instructions which will be given him by the company.

3. Once every week the vehicle is to be sent to the company's garage in a clean condition, viz., one hour having been spent in the usual manner in cleaning and lubricating the vehicle forward of the driver's seat on the morning of the day on which the vehicle comes to the said garage.

4. Should the driver disobey the instructions given to him by the inspector, the owner will, immediately on the inspector advising him, provide another driver who will obey the instructions of such inspector.

5. Should any trouble with regard to the mechanism arise during the week, and the inspector considers that some adjustments and repairs are necessary, the vehicle must be brought to the company's garage immediately for such adjustments and repairs to be effected.

6. Such inspector must have free access to the owner's garage any time in the week and at any hour of the day or night.

7. The owner will pay to the company in respect of such maintenance at the rate of ..... per week, payable quarterly in advance, the first payment to be made on delivery of the vehicle.

8. The company is not to be responsible for the renewal of sparking plugs.

9. The owner to use lubricants of a quality considered to be satisfactory by the company.

10. The distance to be run by the vehicle during any thirteen consecutive weeks must not exceed 6,500 miles. If required the mileage to be recorded by an instrument of reliable make, which must be sealed by both the owner and the company.

11. In no case is the speed of the vehicle to exceed fifteen miles per hour, either loaded or unloaded, and instructions must be given to this effect by the owner to the driver.

12. During the continuance of this contract the owner undertakes to keep and maintain at his own expense the tires in such a condition that the company is satisfied that the mechanism of the vehicle is not being damaged by undue vibration and bumping set up by faulty tires.

13. In cases where it is necessary during the weekly inspection to detain the vehicle for a longer period than one day the company is to give notice of such detention to the owner immediately.

14. No deduction shall be made from the period of three years, during which this agreement is to run in respect of any time the vehicle is out of service.

15. Either party has the right to terminate this agreement at a week's notice should the other fail to carry out, or should commit a breach of any of the provisions hereof, but in the event of the owner desiring for other reasons to terminate this agreement the notice must be a written one of at least one month addressed to the company. Upon the termination of this agreement by the owner for reasons other than the non-performance by, or breach of this agreement by, the company, a proportionate part of the amount paid hereunder for the unexpired portion of the current quarter shall be refunded to the owner.

16. If this contract shall endure for three years, and the cost to the company hereunder for the whole of that period shall be less than the amount paid by the owner hereunder for maintenance—exclusive of anything paid in respect of the half-yearly overhaul—the owner shall be entitled to a rebate of forty per cent of such difference.

17. The company may, if they think fit, in lieu of performing their obligations hereunder themselves, perform the same either wholly or in part as they may think fit by or through an agent from time to time to be nominated or affirmed by them.

* * *

Draft of Letter from the Contracting Company's Agent to the Contracting Company Itself.

Gentlemen—You have entered into an arrangement with Mr. ....., of ....., with respect to the maintenance of the motor chassis manufactured by you, No. ....., as per copy set out on the flyleaf hereof. We hereby agree to carry out such arrangement, so far as it has to be performed by you, on the following terms:

1. All work to be done by us at cost price.

2. We are to send you weekly an account in triplicate, as per specimen annexed hereto, of the labor expended on such chassis, and of the other particulars shown thereon.

3. Accounts are to be rendered by us to you monthly, and within a week from the last day of the preceding month, and you are to send us a remittance for the amount by such account shown to have been expended by us.

4. At the end of each year of the existence of the arrangement hereby agreed upon, an account (in addition to the monthly account mentioned in Clause 3) is to be made up by us for the preceding year, showing the total amount expended by us on or in relation to the said chassis, and despatched by us to you within fourteen days from the expiration of such year. If, after debiting this account with

(a) Any spares used on such chassis at cost price;

(b) Any expenses of your sending any employe of yours to assist us in putting the chassis right (such expenses to be charged at cost price); and

(c) The expenses, at cost, of the half-yearly overhaul at ..... (or elsewhere, if you shall so determine), if necessary,

the sum total of such expenses for the year in relation to such chassis shall be less than the amount which has been received by the company for maintenance thereof under the said arrangement, we are to be entitled to fifty per cent of the difference.

5. Spares to be used on the chassis are to be drawn by us from your works, and you will supply us with a stock of such spares.

6. If Mr. ..... breaks any of the provisions of your contract with him, you are to be at liberty to terminate such contract, and in that event this agreement will also automatically cease.

7. If you consider our work unsatisfactory, or our charges too high, you are to be at liberty by one week's notice to us to terminate this agreement.

8. If you wish to terminate this agreement for any causes other than those mentioned in Clause 7 hereof, or should we desire to terminate the arrangement for any cause, one month's notice of such desire is to be given to the other. In the event of any such determination, an adjustment of accounts will be made up to date of termination.

There are about 35 motor cabs operating in Seattle, Wash.

Manitowoc and Two Rivers, Wis., are to be connected by motor bus.

Eleven years ago the number of automobiles in the United States did not amount to more than 200.

Two motor buses are now making regular trips between Thurmont, Emmitsburg and Gettysburg, Md.

During 1905 the production of horse drawn business wagons used for city and town work amounted to 133,000.

The Berlin electric cab company has closed the working year with a small profit for the first time in its history.

A roadway is no better than its foundation. Laying a good surface does not make a good road of a bad one. Foundations are not receiving enough attention.

Of the 112 delegates from five states who recently attended a dairymen's convention 38 owned automobiles, which are put to various uses in the conduct of their business.

The railroads of this country have spent for construction and equipment over thirteen billion dollars within the last forty years. An equal expenditure on the common highways of the country in the next forty years would be warranted, reasonable and wise.

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Energy Consumption of Electrics

Consideration of the Principal Factors Which Influence the Wattage of Electric Vehicles

By ALEXANDER CHURCHWARD

WHEN studying the performance of the storage battery vehicle the one most important subject is the wattage, that is, the watt hours per ton mile when accomplishing certain predetermined results.

We can rely upon a certain discharge rate from the battery for a given number of hours. We also know that the watt hour capacity of the same battery falls rapidly as soon as a certain discharge rate is exceeded. Therefore, knowing the wattage of a given vehicle, fitted with a given capacity battery, we can readily determine what service the vehicle is capable of performing. The wattage of a vehicle, however, is influenced by a number of factors, the principal ones being:

1. Tires.
2. Motor.
3. Controlling apparatus.
4. Correct gear ratios.
5. Alignment of axles and driving mechanism.
6. Transmission losses.
7. Diameter of wheels.
8. Springs.

The foregoing are influenced more or less by the design of the vehicle. The following factors, however, are primarily exterior to the design, although a good designer will take all of them into consideration and will produce a machine giving the highest vehicle efficiency under average conditions:

9. Road resistance.
10. Grades.
11. Wind resistance.
12. Economic speed.
13. Stops.
14. Acceleration.

* * *

We will now consider the segregated losses consecutively and ascertain how they influence the ultimate or total wattage of a vehicle.

Tires.

Ordinarily standard vehicles are equipped with either pneumatic or solid tires. The tractive effort of pneumatic tires on hard level asphalt varies from 15 pounds per ton for special tires designed for electric runabouts up to 35 pounds per ton for gasoline touring cars. The tractive effort of solid tires on hard level asphalt varies from 18 to 26 pounds per ton, depending upon:

1. Diameter of driving wheels.
2. Revolutions per minute.
3. Load in pounds per square inch or pounds per inch width.
4. Composition of the compound used.
5. Method of attaching tire to wheel rim.

* * *

Design of Motor.

The design of the automobile motor has received a great deal of attention in the past few years, and to-day it represents the highest development in direct current design. High efficiency at normal loads is not the only desideratum. The motor must be designed with the proper characteristics to suit the supply of current, i. e., storage batteries and their characteristics. Experience has demonstrated that the series motor is best adapted to this class of work. While on the subject of motors, it might be well to state that experience has demonsrated, from the vehicle, battery and motor standpoint, that the lowest voltage motors should be built for is as follows:

(1) Vehicles taking not over 1,400 watts on level, 48 volts, 24 cells.

(2) Vehicles taking not over 1,800 watts on level, 60 volts, 30 cells.

(3) Vehicles taking over 1,800 watts on level, 85 volts, 40 to 44 cells.

* * *

Controlling Apparatus.

Since the introduction of the continuous torque controller, it is not necessary to commutate the battery to get a wide range of efficient speeds. The best results are obtained by keeping all the cells in series, and commutating and shunting the field windings of the motors. The action of the continuous torque controller is such that a vehicle can be accelerated more smoothly, more efficiently, and with less damage to tires, batteries and driving mechanism, than with any system which commutates the batteries.

* * *

Transmission Losses.

These include gearing or chain losses, and all bearing losses throughout the vehicle with the exception of the motor and controller losses. Most vehicles to-day are built with anti-friction bearings throughout. Ball bearings should always be used in the motors and countershafts; ball or roller bearings in the wheels. Personally, I prefer ball bearings throughout, and my experience has shown that ball bearings in the wheels are perfectly reliable when properly selected and correctly installed. For the first reduction gearing, the silent chain has proved very satisfactory in regard to maintenance and efficiency. For the second reduction the roller chain is equally satisfactory, but care must be taken in the selection of the make of chain, also the right pitch and number of teeth in the sprockets.

* * *

Correct Gear Ratio.

Unless the gear ratio is correct for the average service the vehicle is called on to perform, the battery is liable to be damaged by excessive rate of discharge when vehicle is accelerating, climbing grades or negotiating bad roads. If the gear ratio is not correct, the energy consumption per ton mile on hard level roads may be low, but it does not necessarily indicate that the all-round wattage of the vehicle will be low under average conditions of service.

* * *

Alignment of Axles and Driving Mechanism.

Unless the alignment is perfect under all conditions of maximum stress the wattage will be high. An axle sprung beyond the elastic limit by overloading may increase the wattage 10 per cent to 15 per cent. A vehicle

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that coasts freely may take too much current when the driving stresses are applied. Therefore, all parts must be in perfect alignment under all conditions to be met with in service.

* * *

Wheel Diameter and Springs.

Small wheels will increase the wattage materially on the average roadbed, because the smaller the wheel diameter the greater the vehicle vibration when going over an obstacle of a given height.

The springs of a vehicle must be correctly proportioned and of suitable material; otherwise, there will be considerable movement of the vehicle body when going over uneven roads. This, of course, means energy consumed which cannot be restored.

* * *

Road Resistance.

The tractive effort of a vehicle will vary with the road surface as per table, taking the tractive effort of a vehicle on hard level asphalt as unity.

1.	Level asphalt hard	1.00
2.	Wood pavement	1.15
3.	Level macadam	1.15 to 3
4.	Plank road	.9
	Cobble stones	1.75
5.	Good dirt road	1.10 to 2
6.	Ordinary country road (dirt)	2
7.	Sand	200

* * *

Grades and Wind Resistance.

The tractive effort due to grades must be added to the tractive effort for a given road surface.

Example: 5% grade on hard level asphalt.
Hard level asphalt 25 pounds per ton.
5% grade = 100 pounds per ton, due to grade alone.
100 + 25 = total tractive effort = 125 pounds per ton.

Below 12 miles per hour, the additional tractive effort necessary to overcome the wind resistance on heavy vehicles is comparatively small. But on the light high-speed vehicles, when running at speeds above 12 miles per hour the wind resistance becomes quite a large factor.

* * *

Economic Speed.

Taking everything into consideration, that is to say, life of battery, tires and maintenance of vehicle as a whole, experience shows that the following table is approximately correct:

Gross Weight.	Type of Tire.	Speed in M. P. H.
1,500 lbs.	Pneumatic	20
2,000 "	"	20
3,000 "	"	18
4,000 "	"	16
2,000 "	Solid	16
3,000 "	"	15
4,000 "	"	13
5,000 "	"	11
7,000 "	"	9
10,000 "	"	8
15,000 "	"	7
20,000 "	"	6

* * *

Stops and Acceleration.

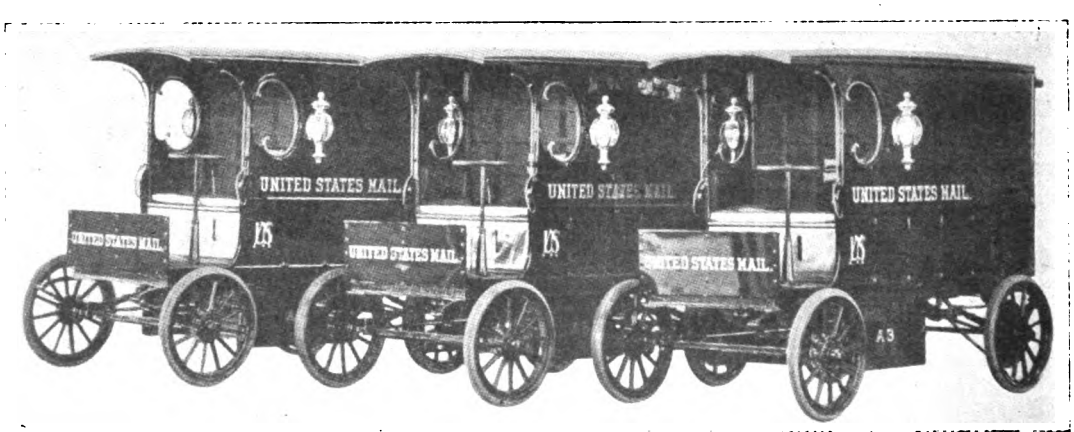
The number of stops per mile will have a very considerable influence on the wattage of a given vehicle. Acceleration should never be too rapid. If it is there is danger of damaging the battery or snapping a chain or gear.

It can be seen from the foregoing that there are a great many factors which influence the wattage, and therefore the performance, of a storage battery vehicle. A few years ago a commercial vehicle taking 120 watt-hours per ton mile was considered satisfactory. To-day the energy consumption has been reduced to 70 watt hours per ton mile, and in some cases as low as 60. Unless a commercial vehicle is capable of running at its full speed, loaded, on hard, level asphalt, at a wattage considerably under 100, it could hardly be said to be successful as far as design and cost of operation are concerned.

TUNGSTEN LAMPS FOR WAGONS.

THE employment of tungsten lamps on motor road vehicles of all kinds would seem to be well advised. Every machine has the necessary source of current supply. Such lamps are now available in any shape or size, and are much more economically operated than incandescent lamps of the ordinary variety.

In an electric wagon the current generated by its storage battery is available for lighting. In gasoline wagons the magneto or the ignition battery can be used, but the latter must have capacity sufficient to serve ignition purposes and also to furnish lighting current.



Electric wagons employed in New York postal service. The use of ten more like these has been authorized.

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The Capital Subway Buses

Service of Machines Which Traverse a Tunnel One-third of a Mile Long in Washington, D. C.

IN PREVIOUS issues reference has been made to the operation of electric buses in the subway which connects the capitol building at Washington with the new senate offices. Illustrations of a section of the route and the machines are shown in this page. The tunnel is nearly one-third of a mile long and is lighted by electricity. Each machine makes the round trip in two minutes, carrying ten or eleven of the nation's lawmakers, or their friends or constituents who may have business with them.

It is planned to shortly extend the underground transportation system and have a similar service operating between the halls of congress and the new office building of the house of representatives, which is located about as far distant from the capitol as the senate building, but in the opposite direction. The tunnel by which the house of representatives building is accessible from the capitol is a duplicate of the S-shaped tube leading to the senators' working quarters.

* * *

When it was decided to build a huge annex on either side of the capitol there was discussion as to the best means of quickly conveying the lawmakers between their two buildings. Obviously an up-to-date system was necessary, for it is frequently necessary that congressmen shall make a quick trip in order to vote on a bill for which a roll-call is demanded, or to meet other like urgent contingencies. Various suggestions were proposed, including moving sidewalks and miniature electric cars operating on a double track system. Finally, however, after full investigation the officials sanctioned the service of electric buses. These traverse a concrete roadway which is of sufficient width for two of the machines to pass at any point in the tunnel. A sidewalk, protected by a heavy iron guard rail, extends the length of the tunnel, and pedestrians may get aboard the motor cars at any point in the tunnel, although it is expected that the vehicles will not make stops between the terminals except under unusual circumstances.

* * *

The machines were built for a contemplated speed of twelve miles per hour. The journey from the capitol to the office building is made in forty seconds, but nearly twice as much time is consumed in making the return trip, owing to the fact that the route is up grade and the machines are, in effect, running backward.

Owing to the limited space at the terminals, and a desire to keep up continuous operation, the vehicles are not turned upon completion of each trip. The design of the bus facilitates this practice. But when the drive wheels are in front the machine is steered with more difficulty and the driver operates at slower speed, which, combined with the slight grade, makes the time consumed in the journey to the capitol greater than that required for the trip in the opposite direction.

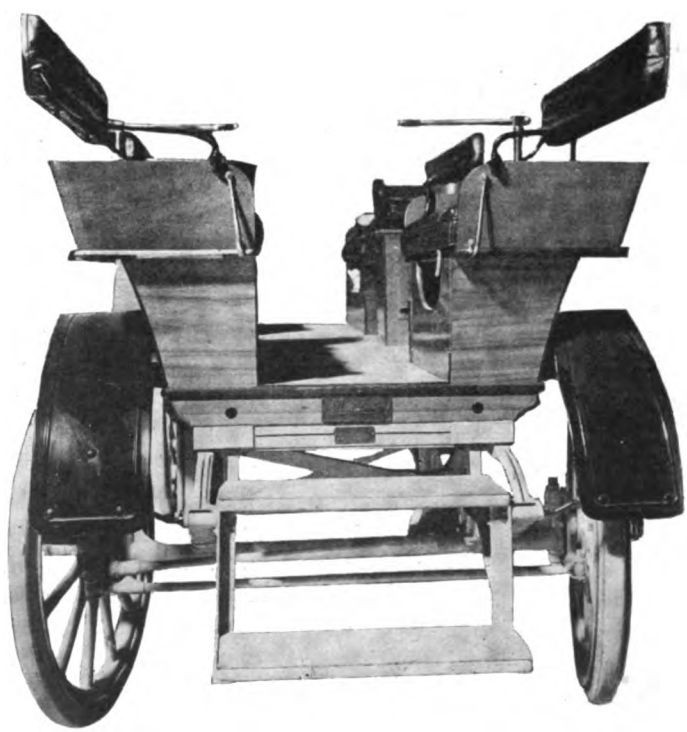
The exigencies above mentioned were in great measure responsible for the design of the vehicles, which is radically different from anything of the kind ever produced. The machines have the appearance of two dog carts placed end to end, and linked by a platform on which are located the operator's two individual seats on opposite sides of the car and facing in opposite directions. At the end of a run the driver changes seats and is thus constantly facing to the front, although the machine is not turned around.

The seats for the passengers extend lengthwise and face each other. Six passengers can be accommodated in the seats at one end of the car and four in the seats at the opposite end. In the busy hours a passenger can always be accommodated in the vacant operator's seat, thus bringing the capacity up to eleven, exclusive of the driver. The bodies of the vehicles are finished in tan color and upholstered with brown leather.

* * *

The machines cost in the neighborhood of $5,000

Side view of tunnel electric bus used in Washington.



End view of one of the electric buses used in the Washington Tunnel.

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each, and it is contemplated that eventually four of them will be in operation between the capitol and the senate office building and probably a greater number between the capitol and the representatives' building, owing to the fact that nearly four hundred representatives, and an equal

Tunnel connecting Capitol and Senate office building in Washington.

number of private secretaries and clerks to the congressmen must be provided for as regular patrons.

The charging of the batteries of the motor buses is done at night, and it is not necessary to remove either the vehicles or the batteries from the subway for this purpose, the charging being done at the electric power plant which supplies light, elevator power, etc., to the capitol and office buildings, and which is in the basement on the level of the subway.

FORTY-FIVE BUSES SOLD AT AUCTION.

LATE last month the rolling stock, plant and supplies used in the operation of the Auto Transit Company's electric motor bus service in Philadelphia were sold at auction, and the ridiculously small sum of $13,700 realized for the benefit of creditors. None of the property brought anything like the price it was worth, seven of the vehicles being sold for $50 apiece and twenty-six for $60 apiece. One machine was sold for $100, the highest price paid.

Prior to the auction it was announced that the various items of property would be offered separately, and that at the close of the sale bids would be received for the property as a whole, with the understanding that if the lump bid equaled or exceeded the sum of the separate sales it would be accepted.

Soon after the auction efforts were made by attorneys for certain of the creditors to have the courts declare it void, it being alleged that the assets should have brought at least 30 per cent more than was realized. Another suit was begun to restrain the sale or removal of the machinery and boilers in the garage formerly occupied by the company, on the ground that all improvements made upon the premises were to remain as the property of the owner.

Acting under orders of the court new bids were received for the assets of the defunct company. When these bids were examined it was found that J. J. Stoer offered $23,500 for the property, E. L. Hare $22,100, and Yearsley, Levine & Company $14,700. The court deferred action.

WORK CAPACITY OF THE HORSE.

DRAFT animals move very slowly and are short lived. The average speed of a team hauling a two-ton load on level streets is rated at 2 2-10 miles per hour, including brief stops. The average speed of a one-horse delivery wagon is about 7 miles an hour. In five years, at the outside, animals employed in either service are practically useless. During that period they are never constantly employed. If they were their term of usefulness would be much briefer. In some cities, where hills and poor paving abound, their term of service is greatly shortened.

On a macadam road, at a speed of 10 miles per hour, a horse will perform 13 miles per day for about 3 years. Assuming load that a horse can draw on a level at 100, he can draw upon grades as follows:

1%.....91	5%.....55
2%.....82	7%.....35
4%.....64	10%.....10

A horse can travel, at a walk, 1 mile in about 20 minutes. At a trot he will travel 1 mile in about 8.8 minutes.

The tractive power of a horse decreases as his speed is increased, and within limits of low speed or up to 4 miles per hour it decreases nearly in an inverse ratio.

At 1 m. p. h. traction is 250 lbs.
At 2 m. p. h. traction is 125 lbs.
At 3 m. p. h. traction is 82 lbs.
At 4 m. p. h. traction is 62 lbs.

THIEVING CAB DRIVERS.

OFFICIALS of the Taxi Service Company, of Boston, assert that since it began business $20,000 has been stolen by drivers who, for a consideration, are taught how to tamper with recording instruments by New York crooks. Four drivers have been arrested by detectives and chaged with larceny. It is said that the men are furnished with keys to the instruments by their instructors.

The police and company officials further declare that an extensive conspiracy exists to defraud motor cab owners of the receipts from service. It is alleged that registers are set back from 50 to 100 miles per day less than the distance they actually record, and the drivers pocket the difference in fares. It is some time since the falling off in receipts was first noticed.

The company had 50 vehicles in use. Many of these used to return to the garage showing service, but little income. The registers always bore out the claims of the drivers. Finally the police were appealed to and detectives were put upon the case. They rode in cabs night and day, compared notes and made their reports to the company. It was then found that some of the drivers had provided themselves with keys, secured from New York, which opened the registers and allowed of their manipulation at will.

Thirty years ago the internal combustion engine weighed from 800 to 1,000 pounds per horse power developed. The automobile engine of today weighs less than 10 pounds per horse power developed.

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The London Gasoline Bus

Peculiarities of a Service n Which Each Machine, Rated to Carry 34 Passengers, Travels from 90 to 120 Miles a Day

By W. WORTHY BEAUMONT

IN THE history of mechanical engineering there are few examples of rapid growth so remarkable as that of the gasoline motor bus. Barely six years have passed since the first vehicle of this type may be said to have been regularly worked in public service. Four years ago the number was negligible; to-day there are over 1,100 employed in London alone. On all these machines seats are provided for 34 passengers. Each vehicle covers from 90 to 120 miles a day, or from 30,000 to 40,000 miles a year.

The favorable reception of the motor bus, despite the occasionally just but more often impatient and unreasonable objections raised by those to whom it does not happen to prove a convenience, led to so rapid an increase of the demand for more machines that the available supply was soon exceeded. The difficulties that have been experienced in connection with the running and maintenance of practically all of the many types now in use, may be largely attributed to this rapidly increased demand, and to the similar and less readily met demand for competent and trustworthy men to either supervise, drive, or repair them. It is the natural result of a change of considerable magnitude, one of the results of the abnormally rapid growth of this new industry.

* * *

There are in use now not less than twenty-four different makes of bus, and of this number twenty-two are driven by gas engines. There is great similarity in external design of the buses—a similarity that is necessarily aided by the use of bodies of nearly uniform type, made to comply with regulations equally applying to all. There are, however, in the design of the underframes and in the details of the mechanism very considerable differences, which, considered with reference to the result obtained, provide an interesting study.

A few of the earlier buses of small power and weight were constructed with single-deck bodies, and, as long as they were in use, the practical indications were encouraging; but the period of service was short and the number of vehicles insufficient to allow definite conclusions to be drawn as to their successful commercial working. Although some of these small buses only carried twelve passengers, and the proportion of passenger load to total load was low, there is no doubt that running expenses were also low, and the earnings per bus-mile sufficient to ensure successful working.

* * *

The types of double-deck buses now used weigh in working order from 3¾ to 4½ tons, and the weight of the full load of sixteen inside and eighteen outside passengers with the driver and conductor averages 4,800 pounds. The total load on the road wheels is, therefore, from 6¼ to 6¾ tons, and may occasionally reach 7 tons. The load on the driving wheels, with the bus fully loaded, is in the most used types about 0.6 of the total load, and it may, therefore, be a little over 4 tons, or, say, 2¼ tons per wheel.

The average weight of the bodies as used in London is 2,900 pounds. The overall dimensions are as follows: Extreme length varies from 18 ft. 6 in. to 22 ft. 6 in.; width over wheel caps, 6 ft. 3 in. to 7 ft. 2 in., the maximum allowed; height to top rail of body, 11 ft. 6 in. to 11 ft. 9 in.

The weights of the various undercarriages illustrated are approximately as follows:

Make.	Undercarriage load.	Complete Bus unladen.
30 hp. Straker-Squire	5,400 lbs.	8,300 lbs.
30 hp. Dennis	6,000 lbs.	8,900 lbs.
24 hp. De Dion	4,200 lbs.	7,100 lbs.
28 hp. Milnes-Daimler	5,400 lbs.	8,300 lbs.
24 hp. Scott-Sterling	6,000 lbs.	8,900 lbs.

* * *

The conditions of service of these heavy vehicles are immeasurably severer than those applying to any other type of motor vehicle. They are continuously used during good and bad weather, and they frequently have to be run over indifferently maintained and sometimes extremely bad road surfaces. Not only is the road speed high and the total weight to be moved usually greater than six tons, but a large part of the period of service is occupied in constantly repeated starting and stopping. This very interrupted running is continued for sixteen or eighteen hours every day, and the daily mileage frequently reaches the high maximum already mentioned. It is not, therefore, surprising that many of the earlier buses were soon found to be in some respects unsuitable for the heavy work they were required to perform. Although earlier experience has been helpful in determining the design of the motor bus, subsequent experience has shown that in numerous cases the severe conditions of service were not sufficiently anticipated.

* * *

The dimensions adopted for many parts, although sufficiently liberal to give reasonable durability for periods or rates of service hitherto customary, were totally inadequate when the rate of working previously constituting a year's service became, in the case of the motor bus, equivalent to only from two to three months' work. To the failures due to rapid wear and breakage, condensed into the shorter period, had to be added other and more serious troubles occasioned by causes even now incompletely understood, if we may judge from the comparatively recent completed designs of some makers. It would seem that the designer had concluded that an engine capable of delivering, for instance, 30 b. h. p., and speed reduction gearing already found to give satisfactory results in conjunction with it, when used as parts of the equipment of a light high speed passenger car, would prove equally satisfactory when required to haul the much heavier but slower speed

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Types of London Motor Buses

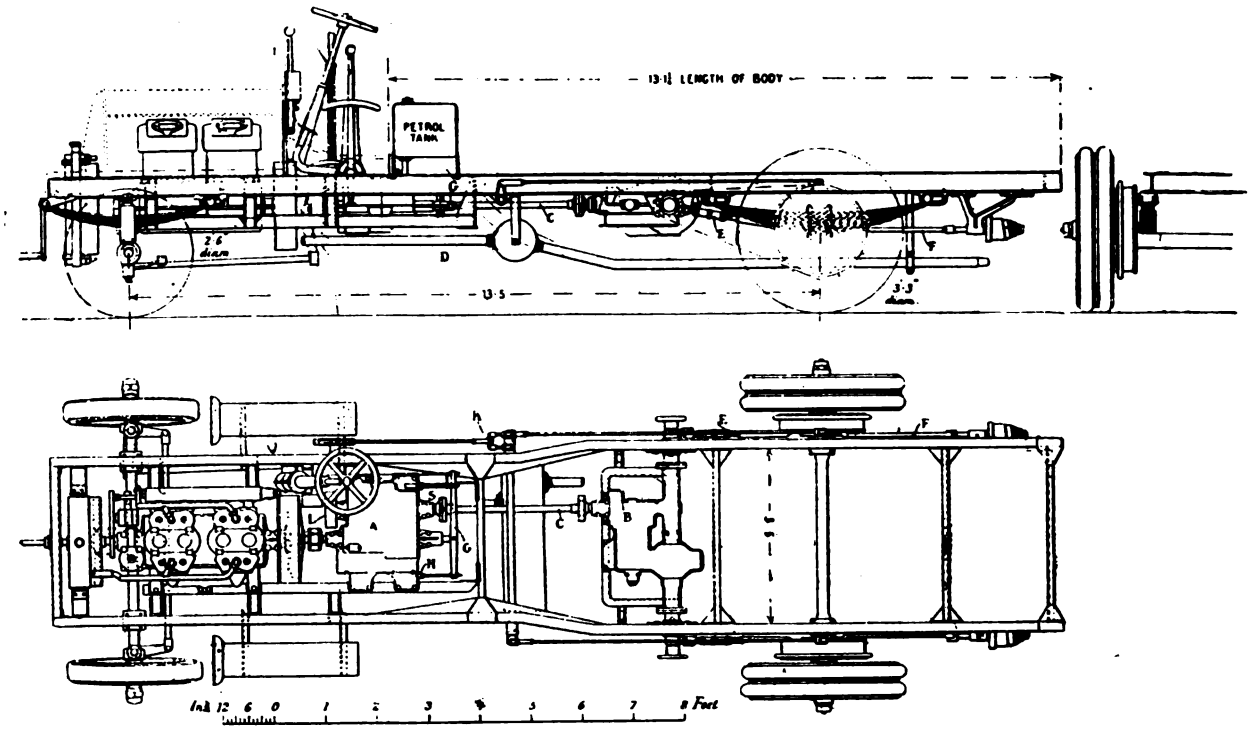

Fig. 2.—30 h.p. omnibus frame (Straker-Squire).

A, change speed gear box
B, bevel and differential gear box
C, universally jointed shaft
D, underframe
E, slotted radius rods
F, drag bars
G, clutch operating lever
H, fulcrum rod
J, engine throttle regulator
K, equalising brake link
L, foot brake drum

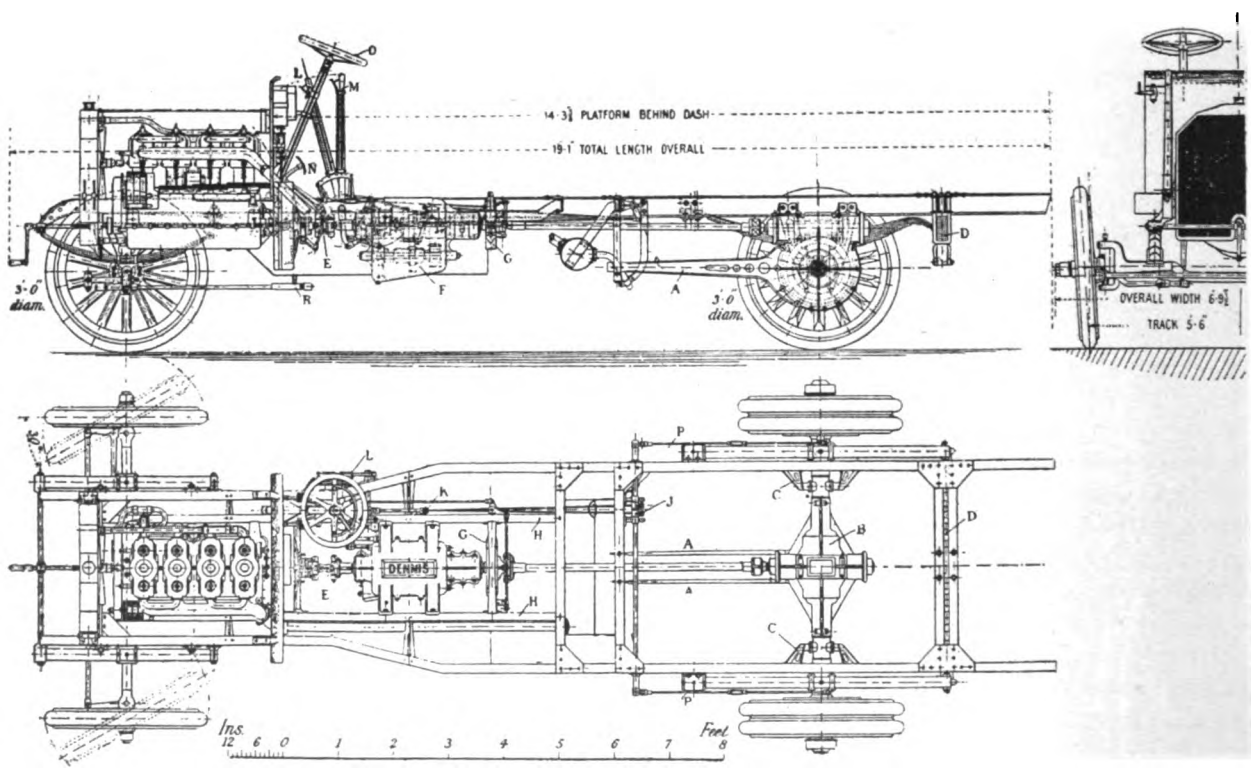

Fig. 3.—30 h.p. omnibus frame, fitted with worm drive (Dennis).

A, torque bars
B, worm and differential gear box
C, axle horn brackets
D, transverse spring
E, double universal joint
F, change speed gear box
G, foot brake
H, underframe
J, brake levers
K, equalising brake link
L, side brake lever
M, change speed lever
N, clutch and foot brake pedals
O, engine throttle regulator
P, side brake rods
R, steering gear buffer box

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vehicle. This expectation was, of course, doomed to disappointment. Parts of the transmission mechanism and gearing have been rapidly destroyed, and the engines, although in a more favorable position, have been shaken and pulled to pieces, as a result of the heavy and repeated inertia stresses experienced when starting and stopping the bus.

The speed of the engine may be suddenly reduced, without inconveniently high rate of acceleration of the vehicle, and its energy delivered at a high rate to the transmission gear; and a similar effect may and does often occur when the engine speed becomes reduced by overloading during hill-climbing, before the conditions are altered by use of the change speed gear. Reduction of the severity of the stresses produced in this way depends very much upon the capability of the driver, but it is necessary to provide for relatively high rates of acceleration, and to so increase the strength or stiffness of the working parts that their endurance may be satisfactory, even though there be no increase of the horsepower of the engine. Stresses of even greater magnitude have to be resisted by the whole of the parts included between the driving wheel tires and brakes. Prominence has been given to the cause and occurrence of these destructive stresses because of frequently expressed surprise, and because, although often unrecognized or under-estimated, they are responsible for much of the trouble that has been and is now being experienced.

* * *

The question of the amount of power that may be usefully employed is one that requires very careful consideration, for on its correct determination depends the character of design and to a large extent successful working. There are in service to-day buses with engines of only 20 hp., a large number with engines of 24 hp., and an increasing number with engines developing between 30 and 40 hp. The larger powers have been employed after considerable experience with the smaller engines, and there remains a decided tendency to use the higher powers mentioned with the designs of undercarriage now in common use. Engines of as much as 50 hp. have been tried, but only to a very small extent, and it is unlikely that there will be any further increase in their employment.

* * *

The increasing use of engines of not less than 30 hp. directs attention to the reasons that have led to their adoption, and invites investigation of the soundness of those reasons. The greater engine power makes more rapid acceleration of the bus possible, and, without necessarily increasing the maximum speed, increases the average speed. Higher speeds of hill climbing are maintained, and the change speed gears are not so frequently brought into and out of action. The work of driving is consequently simplified, and when there is slight temporary loss of power due to one or other of the occasionally unavoidable causes, the bus may be kept running in service without marked inconvenience until completion of the journey. The addition to the weight resulting from the use of the larger engine is not in proportion to the increase of power.

Against these possible advantages have to be set the disadvantages of increased weight of the more powerful complete bus, and the power of running at high road speeds, inevitably attended by more rapid wear and failure of the rubber tires. Increased consumption of fuel and lubricating oil has also to be considered. The effect of high road speed is not, however, confined to increased wear of the tires. With greatly increased severity of the road shocks, there is necessarily greater wear and tear of all the active parts of the undercarriage.

* * *

It has already been remarked that engines of about 24 hp. have been largely used, and continue to be used, and the question arises as to whether the buses of these engines have shown themselves to be inferior to those of higher power. Speeds considerably in excess of that permitted, namely, twelve miles per hour, can be and are maintained on level or nearly level roads; but on the hills to be found on some of the London routes it is frequently difficult to run at the speeds at which the horse-drawn omnibus is usually driven. If the hills are to be climbed at high speed, and a speed of more than twelve miles per hour is to be maintained on the level roads, then the engine of higher power becomes necessary; but in this connection it must be remembered that discretion must be used as to the relative importance of rapid acceleration and of economy of fuel. At the present time buses constructed to run at twelve miles per hour are now run at considerably higher speeds, and this entails injurious racing of the engines and noisy working. On the whole, experience tends to show that a 30 hp. engine is ample for London use, especially if anything like proper observance of the regulation speed properly allowable to such vehicles is to be maintained, and this speed regulation should be followed in the interests of the owner of the vehicles as well as in that of the public. In order to prevent this high speed running under any circumstances, a system of automatic control is required, which, while limiting the maximum speed, will yet leave it in the power of the driver to accelerate rapidly up to the predetermined limit. With a 28 hp. engine, the mean rate of acceleration to twelve miles per hour is about 1.25 feet.

* * *

Drawings of some of the most frequently used undercarriages have been selected to represent the general practice now obtaining as regards the general disposition of the machinery and the forms which it commonly takes. Those which are here given differ in some of the important details, and some of them can be considered representative of the methods adopted by nearly all of the many makers now engaged upon the construction of gasoline motor buses.

The framework of the undercarriage is generally similar, so far as the use of a main frame for the support of the whole load, and a secondary or underframe for the attachment or support of the engine and some of the transmission gearing, is concerned, but there are three methods of construction which differ considerably. These methods may be classed as those in which:

(1) The main longitudinal and transverse members are formed of rolled steel channels and angle steel of uniform depth of section from end to end.

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Types of London Motor Buses

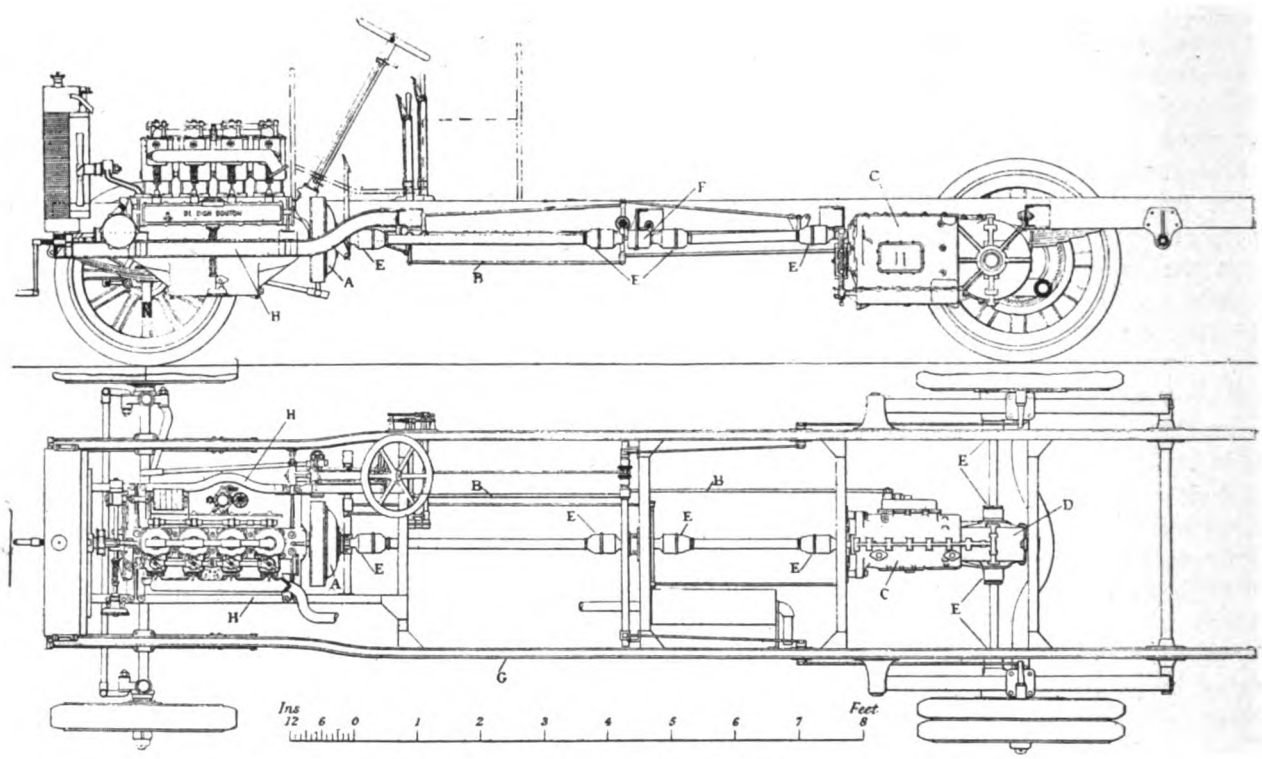

Fig. 4.—24 h.p. omnibus frame (De Dion).

A, engine flywheel and disc friction clutch
B, change speed gear operating rods
C, change speed gear box
D, differential gear casing
E, universal joints
F, centre ball bearing for driving shaft
G, armoured wood main frame
H, underframe members

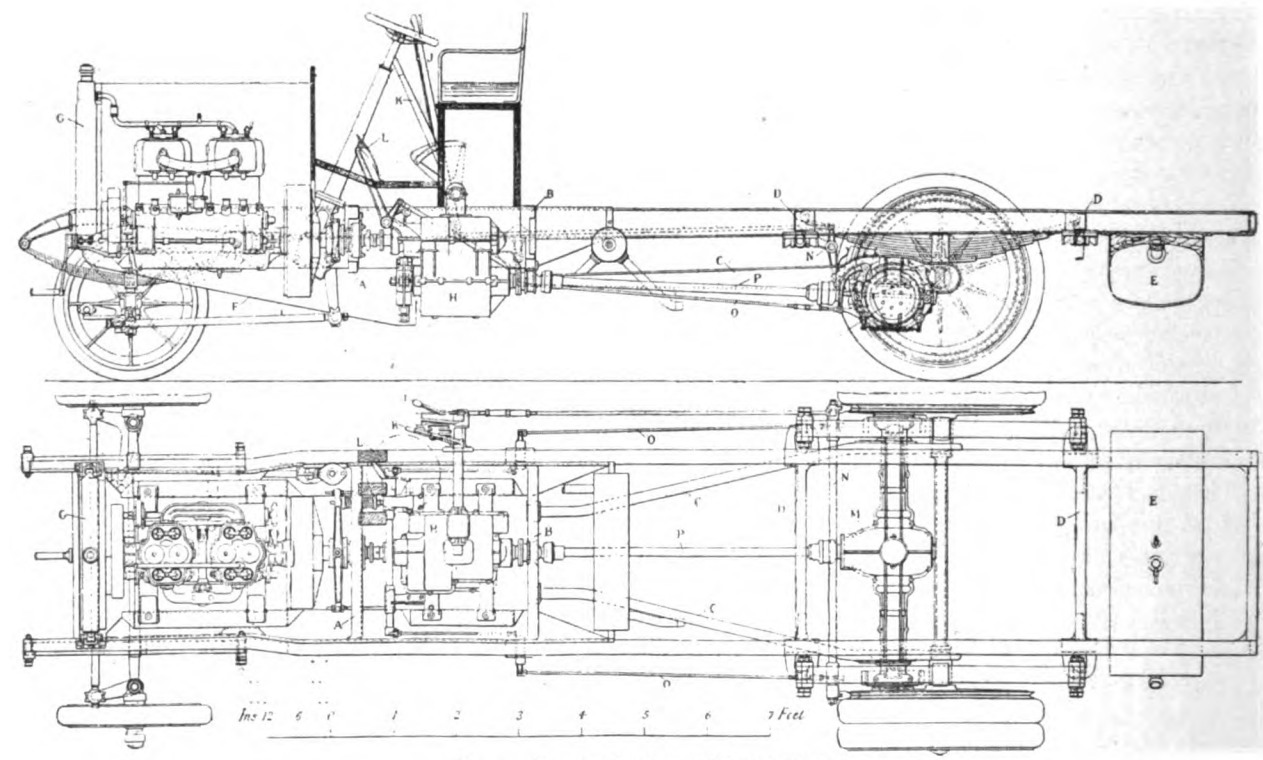

Fig. 5.—28 h.p. omnibus frame (Milnes-Daimler).

A, pressed steel spectacle plate
B, pressed steel frame member
C, pressed steel reach bars
D, pressed steel frame members
E, petrol tank
F, close fitted undersheathing
G, honeycomb water cooler
H, change speed gear box
J, side brake operating lever
K, change speed lever and gate quadrant
L, clutch, gear box brake, and countershaft brake pedals
M, bevel and differential gear box
N, road wheel V brake shaft
O, countershaft brake rods
P, universally jointed driving shaft

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(2) The longitudinal and some of the transverse members are of pressed steel, with a depth of section of the main longitudinals greater at the center and tapering towards the ends.

(3) The longitudinal members are made of wood encased or stiffened by steel channels or flitch plates with steel transverse members.

For purposes of comparison sections of maximum depth of the three types of main frame are shown by Figure 1. The relative powers of resistance of these frames to bending are respectively, in the order given, 1.37, 1.78, and 1.0, from which it may be inferred that Type 2 is that which should give the best results in service, so far as strength of this part as an element is concerned.

* * *

Type 1 is representative of that used by the principal makers for some years. It has been found of insufficient strength to resist the bending stresses experienced in service. Nearly all of them showed signs of distress by bending at a position a little forward of the front end of the omnibus body, and it is obviously the part of the frame which would most severely feel the bending efforts and efforts productive of contrary flexure. In front of this critical part of the frame the load is distributed between the points of attachment of the front springs, and behind it considerable stiffening effect is obtained by fixing it to the comparatively rigid omnibus body. The severest bending stresses undoubtedly occur when a fierce clutch is suddenly dropped in, or when the brakes are instantaneously applied, and aggravate the effect of the pitching that may be observed when the omnibus is traveling over a bad road surface. Nearly all these frames have now been stiffened or reinforced, either by the use of truss rods or stiffening plates of various forms.

The type of frame represented by No. 2 has not been so much used as No. 1, but it has been adopted by at least one maker of great experience. There is a growing tendency to use it, although it is a more expensive form of construction than the heavier form represented by No. 1. From the point of view of reduction of weight and correct use and disposition of the material, it is an improved form, but as a deeper section of lighter scantling is employed, the junction of frame members has to be very well designed and made to resist loosening by working or bulging and tearing away. Some of these frames now in use, and made in France, are showing signs of distress, as before, by bending of the longitudinal members.

The type of frame represented by No. 3 has been used with only three types of omnibus, but the particular form shown has proved to be very successful as used with the De Dion omnibus (Fig. 3). Its strength, judged merely from the section and with the combination of materials taken into consideration, is much less than either of the other types, but there is no doubt that it is a livelier or more elastic frame and capable of undergoing greater deflection than the other types before deformation occurs. A frame that is rigid, or is of a section from which little deflection can be expected without permanent change of form, must be of greater weight than the more flexible frame, and for these reasons the armored wood frame is good.

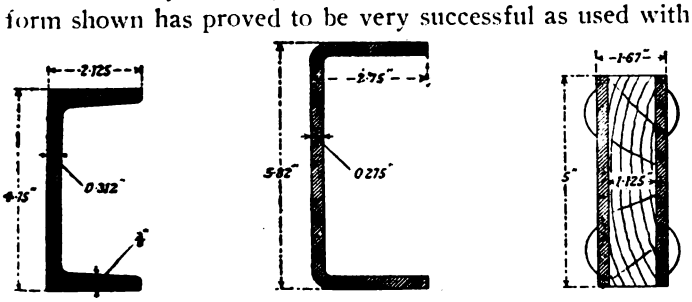

Fig. 1.—Three types of main frame sections.

Two examples of rolled steel frame construction are shown by Figs. 2 and 3, as used with the Straker-Squire and the Dennis omnibuses. In the former the reinforcing plates referred to may be seen in the plan, and in both types the form and arrangement of the transverse members is shown, and the nature of the attachments to the longitudinal members. In both these designs, it will be seen that a secondary frame, hung from the main frame, carries the engine and change-speed gear box. In Fig. 2 the position of this frame is indicated at D, and in Figs. 3 and 4 at H.

Fig. 5 shows the pressed steel frame, as used with the Milnes-Daimler omnibuses. In this design, the material has been disposed to the greatest advantage, and it is interesting to note that in some ways parts of the framework are satisfactorily used for two purposes. It will be seen for instance, that the dished stiffening plate, extending from the forward end of the frame to the back end of the gear box, reinforces, and also forms part of the means of support of the engine and change-speed gear box, and partly takes the place of the undersheathing below the front part of the frame. There is not much provision in any of these frames for racking or corner stresses, but such provision as is made by the use of web or gusset plates at angle junctions appears to give sufficient strength for the frames of lighter automobiles.

With the exception of the sagging of the frames referred to, nearly all of the types in use have resisted the constant twisting and working to which they are subjected without pronounced trouble by loosening of rivets and bolts at the joints, and have indeed only given way in this respect as a result of bad workmanship. There are very few frames so stiffly constructed that some twisting or elastic flexure cannot occur, nor is it desirable that they should be; but it is desirable that this flexure should be fully recognized and provided for in the machinery attached to them. This necessity is far from being generally met.

Even in some of the best motor buses the connection between the clutch drum or shaft and the gear box shaft is by rigid coupling, just as though these parts were fitted to a heavy rigid bedplate like that of a direct-coupled central station engine and dynamo. In this latter case, it is necessary, or at least should not be harmful. The engine or the dynamo are never or seldom moved from their bed, and, if they are, they are put back again carefully with time, light, and every requisite for accuracy.

(To be continued.)

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Maintenance Cost of Electric Fire Vehicles

Horse Drawn Fire Vehicles are Shown to Be Much Less Economical Than Electrics in Vienna

MAINTENANCE costs for any kind of motor-driven fire vehicles are not easily obtained. In a recent issue we presented the verified figures for the upkeep of the gasoline machines used in the Springfield, Mass., fire department. They are typical of the economy of vehicles of this type. For examples of the electric fire vehicle service, however, we must look abroad and examine the behavior of the machines of this class which are installed in Vienna, Berlin and Paris.

* * *

The Vienna fire department, which is equipped with 59 electrics costing about $175,000, which sum will be recovered by the economy of their service in eleven years, offers the best study, although not the most elaborately detailed. The following table compares the old and new style of service, horses and motors, and also takes account of charges for interest and amortisement:

Annual Upkeep of Horses and Motors.

One horse drawn train	$ 4,387.20
One motor train	2,564.00
Annual saving	$1,823.20

A "train" is here understood to consist of four vehicles, namely, one for firemen, one for apparatus, one for the first-aid carbonic acid engine, and one for the steam pump. The present Vienna fire department train, however, consists of five vehicles.

In the Vienna fire service the average effective life of a pair of horses is calculated at four years and four months. The batteries are also considered good for that period. But as horses cannot be on duty day and night it is necessary to provide spares in the ratio of six pairs to four vehicles.

* * *

The Vienna motor fire service owes its origin to experiments conducted for three years with two electric machines sold in bankruptcy proceedings and once employed in hauling merchandise. The vehicles were remodeled, and from their operation it was concluded that properly designed electric machines would answer every need of the fire department service. Accordingly the city council approved the purchase of vehicles built under the Lohner-Porsche patents, which provide front wheel driving by hub motors. The high speed of these machines gives a rate of travel equal to 33 miles an hour. Batteries weigh 1,500 pounds. The total weight is about 4½ tons. One front and one rear wheel, both on the same side, are equipped with a detachable anti-skidding device consisting of a metal studded chrome leather covering felloe and tread.

It is claimed as a special advantage of front wheel driving that all four wheels may be braked, the front ones electrically and the rear ones mechanically. Batteries are located in front. To allow easy and quick manipulation the cells are distributed in four compartments. A distance of 38 miles is obtained on a single battery charge. The current consumption is considerably below 100 watt hours per ton mile.

The following description of the electric hub motor of the Vienna machines is supplied by our contemporary, Motor Traction: "In the motor the magnets are placed in the center, while the armature revolves around the outside. The coils are manufactured of flat copper ribbon which offer ample dimensions, but owing to their shape save much space without affecting the economical working of the motor. The collectors—the only parts of the motor subjected to friction—are disposed on the outer side of the wheels, as it is claimed that such an arrangement prevents the brushes from being lifted by concussions of the vehicle; consequently losses by sparking are avoided. As the magnets are stationary, when the rear wheels are driven these are fastened on the axle, and in the case of a front wheel drive are secured to a hollow stub axle turning on steering pivots. In this connection the design of the steering forms a very important feature, for the center upon which each steering wheel turns is situated directly over the point of contact which that wheel makes with the ground. Consequently, if the circuit in one of the motors becomes broken by accident, the other motor is unable to develop a dangerously rotative momentum of force which might overcome the effort of the driver on the steering wheel, and thus deflect the steering and cause disaster. The wiring arrangements afford series or parallel control at the controller, and here five speeds forward are obtainable, besides three reverse speeds, one stop position, and three more positions for electric braking."

A company has been organized in Freeport, Ill., to operate motor cabs.

The Pittsburg Motor Truck Company, recently organized with capital of $100,000, will produce its machines in Koppel, N. Y.

The Nassau Transportation Company will operate six motor buses between Mineola and Long Beach, N. Y.

The Plainview-Lubbock motor bus line has been sold to Taylor, Hatch & Rosser of Lubbock, Tex.

The meters of all motor cabs in Washington have been tested and tagged by the official sealer of weights and measures.

The title of the Homer Auto Truck Company of Homer, Mich., has been changed to that of the Homer Gas Engine Company.

In New York City last year the cost of feeding horses engaged in hauling coal was $49.32 a head more than in the preceding year.

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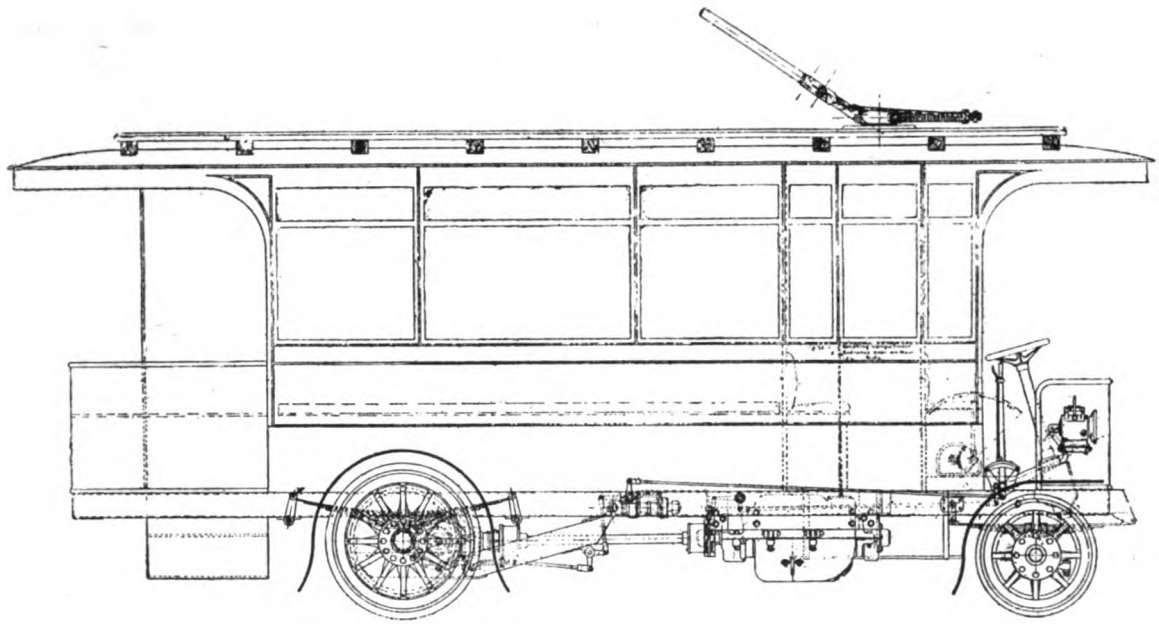

Type of railless electric bus which it is proposed to use in England.

Railless Trolley Traction

Description of Services in Which Buses and Wagons Are Operated from Overhead Electric Wires

WHATEVER merit may reside in trackless trolley transportation is definitely known only to the few who have made practical application of it. Here we have only a speculative acquaintance with it.

Although at present the operations of the railless trolley bus or wagon are exclusively confined to European countries, it is rather probable that their value will soon be somewhat extensively tested in Great Britain. If this should come to pass we may then anticipate the introduction of similar service in this country. A syndicate has been organized in Edinburg to operate railless trolley electric buses which will carry 34 passengers. The sum of $150,000 has been gathered for the promotion of the enterprise, which amount, it is said, is sufficient to provide overhead equipment between the Scotch capital and Dalkeith and purchase six vehicles to run at ten-minute intervals. Two towns on the outskirts of Vienna are connected in this manner, this latter installation having been established as a result of the successful operation of two similar services in the same neighborhood. The Austrian machines are equipped with motors in the rear wheels. Several other towns in Austria are scheduled to be provided with transportation of this character.

It is European practice to retain the electric rail car method of driving, minus the rails, the current being conducted to and from the vehicle by duplicate trolley wires.

* * *

The first practical application of railless electric trolley traction was known as the Lombard-Guérin system, and this is still in operation at various places in Europe, notably in the outskirts of St. Malo and Fontainebleau. This pioneer system employs a small motor-driven trolley, which actually runs on the overhead wires, ahead of the vehicle to which it acts as a feeder. A pair of loose cables connects the little self-propelled trolley with the road vehicle. Certain difficulties were experienced with the independent trolley motor and with the arrangements for cars to pass each other on the Lombard-Guérin system. These hindrances, it is claimed, are avoided in the new type of plant which is now being proposed by the railless electric traction company in England.

* * *

The English vehicles will be operated by what is known as the Max Schiemann system, which was first operated in Westphalia in 1903 in the transportation of merchandise. The early cars were fitted with three-phase electric motors on the front wheels, and steering was effected by the rear wheels. The current supply and the return were secured, in this early example as in the later equipment, by the provision of two overhead trolley wires and, on the early models, two swivel trolley poles were carried by the motor vehicle. Experiments were tried with roller trolleys, and afterwards with long shoes of specially soft metal, but these double-pole arrangements were found to present considerable difficulties with regard to the passing of cars. Where the traffic does not warrant the provision of a separate pair of overhead conductor wires for each of the "up" and "down" lines, the passing of vehicles in opposite directions has to be effected by the removal and replacement of the trolley contact attached to one of the cars.

The success of the experimental undertaking in Westphalia led to the establishment of other lines, two for merchandise transport being organized at Veischedethal and Wuerzen, which were opened in 1904 and 1905 respectively, and a passenger line at Lyons being inaugurated in 1905. Ahrweiler to Neuenahr was the next route to be served, and this was opened in 1906. The most recent installation is that at Mulhausen, Alsace, and this was only completed last year. At Mulhausen the equipment em-

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bodies a single pair of overhead wires on each route, and current is collected therefrom by means of an improved single trolley pole which carries two articulated collectors. The vehicles are motor-driven on the front steering wheels, which are fitted with rubber tires. The rear wheels are 4 feet 6 inches in diameter, and are steel-shod.

* * *

The machines which are intended for the services about which negotiations are now proceeding in various parts of Great Britain, are to be built much on the lines of the ordinary motorbus. They are of the single-deck type, and have all four wheels rubber-tired. The wheel base is 13 feet and the overall length of the machine is 23 feet 6 inches. The normal height of the trolley wires from the ground is 21 feet 6 inches, and the trolley arm, which is carried on the fore part of the roof, is so constructed as to allow a lateral deviation of 10 feet on either side of the overhead wires. Where it is intended to operate lines of vehicles on this system in the streets of towns or cities, two separate pairs of overhead wires have to be installed for the "up" and "down" lines respectively, so that, altogether, a total width of 40 feet of the roadway between the curbs is then at the disposal of these railless machines.

In this type of omnibus the electric motor is carried on a supplementary frame, midway between the front and back wheels, and the drive is taken back through a universally-jointed shaft to a differential gearbox. This last unit is carried on a substantial perch frame, which is triangular in shape and is built up of channel steel. The frame is pivoted, at its front end, on a cross-member of the main frame, by means of an eye-bolt, which is mounted on rubber buffers. The final drive is of the internally-toothed rack and pinion type. A counter-shaft brake, which is foot-operated, is fitted immediately behind the motor, and two other brakes are carried on the final-drive pinion shafts. All brakes are of the locomotive shoe type. The steering gear, axles, spring suspension and many other details are of similar type to those of the standard modern patterns of three-ton motor vehicles.

The claims put forward on behalf of the railless trolley vehicle are principally based on the low cost of installation and subsequent low operating charges. No attempt is made to combat the ordinary electric railway which provides frequent car service.

WHY SPRING WHEELS ARE NOT USED.

FOR a great many years ineffectual attempts have been made to establish the merit of the principle underlying spring wheel suspension. The patent office of records in every civilized country are cumbered with such devices, but, except in rare instances, they have never been developed beyond the design of a model. Plainly, then, something is wanting in order to recommend spring wheels to the millions who might benefit from their employment.

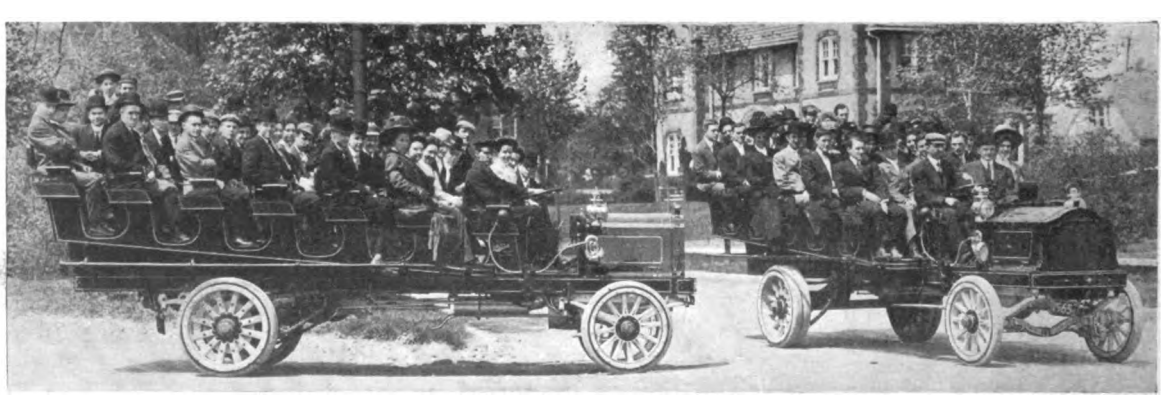
One who has attentively studied their construction and performance declares that they have three grave faults, namely, limitation of space for springs, excessive weight, and brief life.

As the average size of wheels on commercial motor vehicles is only about 36 inches in diameter, and the largest not more than 42 inches, there is only eight or nine inches of spoke between the hub and the felloe (and even less on rubber-tired wheels); and, as the complexity and direction of strains and movement render it imperative that a number of springs be used in each wheel, this valuable space is insufficient to accommodate springs and brakes of ample strength and size to be of practical use—if made sufficiently strong to bear the heavy stresses, and to stand the rough shocks imposed upon them, they lack the elasticity which they were intended to possess. Everyone interested in the commercial motor vehicle industry knows the importance of the weight question, and, unfortunately, the additional weight incurred by spring wheels is not justified by the results of past experience. The moving parts of most spring wheels are so numerous, and the parts so difficult to protect from mud and rain, that very rapid wear takes place, and they soon become noisy.

Attempts have been made, from time to time, to employ flexible spokes in the construction of spring wheels, thus doing away with the necessity for loose springs and a large number of parts, but with poor results, as, owing to the severe strain and continual bending, the metal of which the spokes are made soon becomes crystallized, and fracture takes place.

The Commercial Tractor Company has been organized in New York City with capital of $100,000.

The Buffalo Taxicab Company has been formed with capital stock of $200,000.



Packard 3-ton truck chassis equipped for sight-seeing service at Alaska-Yukon-Pacific Exposition in Seattle. Capacity of each machine, 34 passengers.

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Economy of Automobile Transportation

Substance of Lecture delivered before Institute of Arts and Sciences in New York by Herman F. Cuntz, M. E.

NO FAR-SIGHTED person can but appreciate that in a very short time the place of the automobile will be thoroughly recognized and appreciated by all. It is only a matter of education, in which time is an element. In a sense the extension of use of automobiles has increased more rapidly than the education of the populace.

First and foremost consider that to be an advantage a new mode of transportation must either transport freight or merchandise at a lower cost than previous methods, or it must transport persons more quickly or at less cost. In considering this the cost of transportation from the origin to the final destination is most important. Consider, for example, that freight is to be carried from a wholesale house in a city to a retail store in a suburb 20 miles distant. The old method would involve expressing or carting to a railroad station; then transportation by rail to another station, and there trucking would add further cost and time to the movement. A motor truck takes its freight from the wholesale store directly to the retail store, and if one road is blocked it takes it by another road. A tie-up on a railroad, forming only a small link in the former method of transportation, may entirely prevent delivery for days.

The same applies to passenger transportation for short distances; but another factor enters in personal use. Instead of the tracks by rail, smothered in dust in warm weather, an automobile transports the family direct from a city abode, with all the minor equipment, through an open, pleasing countryside, never before seen, and lands them at the doorstep of their country home.

* * *

As to the speed or radius of operation of different kinds of locomotion, some comparative figures will be instructive. One hundred years ago horses were the only means of travel. A horse may carry you 8 to 12 miles an hour in ordinary daily use, and for usual purposes transporting passengers 30 to 40 miles a day was and is good going. Pony post and special stage coach lines, of course, exceed these figures; but if speed is in question, consider only the best figures of a running horse, and the fastest mile made was at the rate of about 37 miles an hour. A 4-mile running horse record stands at a speed of about 33 miles an hour. Years ago a trotting horse made a record for 100 miles, but the average speed was only a little over 11 miles an hour.

The railroad was a novelty less than 100 years ago. In fact, the first demonstration consisted of a circular track near London, where locomotive and train were exhibited, and admission charged to see the wheels go round. Eighty years of development of the locomotive has given us a train which has made 960 miles at an average speed of 60 miles an hour. The best record of locomotive and train, for a five-minute run, is at a speed of 120 miles an hour. These locomotives now exceed 100 tons in weight.

As for power boats, Robert Fulton, 100 years ago, slightly exceeded 4 miles an hour in his trip from New York to Albany. He was granted an exclusive concession for the use of steam-propelled boats on the rivers of New York state, provided he could propel a boat more than 4 miles an hour. To-day power boats have gone at a speed of 36 miles an hour, while ocean greyhounds, carrying fuel for 3,000-mile trips, have approached an average speed of 25 miles an hour under the impulse of more than 20,000 horsepower.

* * *

After only *ten years* of development of the automobile we have a small wheeled structure, with self-contained power and control, which has traversed the ground for one minute at a speed of 127½ miles an hour. Automobiles have made a continuous run of 100 miles at a speed of 79 miles an hour; automobiles have run continuously for 24 hours at a speed in excess of 49 miles an hour. Consider also that automobiles have been run 36 hours with their engines constantly going. It is a simple matter for an automobile to carry sufficient fuel to run 250 or 300 miles without a stop for anything. In comparison, consider that locomotives may run 50 miles, though usually less, and then must replenish with water. A comparison recently made in the operation of one of the well-known automobiles, of which there are thousands in use, showed that the weight of fuel and supplies for its operation was a little over 5 per cent of the total weight. On the other hand, an oil-burning locomotive of a most modern type requires fuel and supplies to the extent of over 15 per cent of its weight.

To complete the comparison of different means of locomotion, it is well to consider that the bicycle, which at first was a luxury, has come into its place of general utility. The automobile, which only a few years ago could be used by a few, is now in a large proportion used either for direct or indirect gain.

* * *

With an appreciation of the useful work to be accomplished, the next thought must necessarily lead to the question of the highway. The common roads of the country will of necessity be the arteries of swift passenger and freight transportation. Considering the passengers carried by railroads in 1908 and the number of miles carried, as compared with the number of people carried per mile by automobile, we find that automobile passenger miles at present would approximate 0.7 of 1 per cent. If however, we consider the rate at which railroad construction is increasing and its traffic, and the increasing use of the automobile conservatively estimated, this proportion will materially change by 1915; and estimates indicate that the passenger miles transported by automobile will then be not less than 7 per cent of the passenger miles of railroad. The time has not yet come when a similar comparison can be made with respect to the amount of large freight transported. Small freight transportation for short distances will be the lot of the automobile, which will gradually supplant the horse vehicle, as it is now

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proven in numerous cases to be less expensive and vastly more convenient. In cities there are some highways, but most streets are only air and sunlight wells with their bottom paved, and therefore come in for different consideration. From a hygienic standpoint, municipalities are awakening to the advantage of the automobile, and it may not be amiss to mention that as early as 1896 the town of Cannstadt, Germany, looked upon as the birthplace in Germany of its automobile industry, considered seriously the exclusion of the horse from the central part of the city. An ordinance to that effect was considered 13 years ago.

The 100-ton locomotive and its trailers cannot move a foot without a specially prepared road, and when prepared it leads only to predetermined points. An automobile starts anywhere and goes anywhere. They use the highways that they find, and the marvel of it is that they have been able to negotiate at all the common roads existing in the wilds of the country. As the maker has developed the mechanism which can be and is being used for economy in the many fields of application, is it not reasonable that better and more highways of the country should be provided for their travel?

* * *

Recently compiled statistics showed that 1.8 per cent of the farmers of the United States own automobiles. With the increase of the past few years it is evident 10 to 15 per cent of the farmers of the country will own automobiles before ten years have passed. One of our senators recently announced on the floor of Congress that it had been found economical to use automobiles on ranches to round up stray horses. Far western mining towns have regular inter-communication for carrying freight and passengers by automobile.

Nevertheless, the sum total of highways, we are told, exceeds 2,000,000 miles, or, generally speaking, one mile of highway for every square mile of land in the United States; whereas, there is only .07 miles of railroad for each square mile of land. On the other hand, there are about 2.5 miles of railroad for every thousand inhabitants and over 36 miles of highway. Is it not reasonable, then, that the highways of the country be put in such condition that they may be used by every inhabitant, now that the ingenuity and means of the country have provided a vehicle that every individual in our vast country can use?

* * *

The sentiment is growing, and soon there will be a universal recognition, that every mile of common road in this country should be made suitable for rapid and economical transportation. Every town in the country must be reached by a suitable road. Five thousand dollars a mile, or its equivalent in labor and material, would be required, and this means that the roads will be in suitable condition only in 50 years should the equivalent of 200 millions be expended annually. This seems a large sum, but consider that five millions a year by each state would accomplish the result. Divided as to population, it will be seen that there is not a state in the Union which cannot well afford to spend its proportionate amount to make possible road travel in the now accepted form to every village and hamlet within her boundaries. The aggregate so spent would prove warranted when we consider the saving to the farmer and others interested in transportation of articles. It is hard to measure in dollars and cents the advantage gained, but the fact that one and all quickly substitute the use of automobiles, where good roads are available, is proof positive that they are the gainers, whether or not they will admit it.

* * *

The railroads of the country have spent, as charged to cost of railway and equipment, over 13 billion dollars. This has practically all been within the last 40 years. It is true that the national and state governments would not receive in direct payments, as for freight and passenger transportation, earnings such as have prompted the private investment of this vast aggregate sum. But the indirect gain to the community at large, by every citizen, will be a reality so appreciated and eventually to be estimated in tangible form, that it is futile to gainsay the fact that an expenditure on the highways of the country in the next 40 years, equal to the private outlay on railroads in the past 40, would be anything more than warranted, reasonable and wise.

When 2,000 new automobiles are shipped to one state, as Iowa, in one year, and when we consider that automobiles in the last ten years have been purchased at an aggregate value of over 370 million dollars, is it not ample to prove that the state and national government should build or remodel highways even though it be at an expense of 200 or 300 millions a year until all the roads are suited to the new mode of transportation?

* * *

If more detailed information to prove the benefits at large is necessary, I need only cite that in a recent year when manufacturers of automobiles received an aggregate of 90 millions for product shipped from their factories, there was, owing to the use of automobiles throughout the country, such a stimulation of activity and industry in every direction that it represented a circulation of money in the United States of not less than 467 million, or more than five times the cost of new automobiles throughout the country, such a stimulation of activity and industry in every direction that it represented a circulation of money in the United States of not less than 467 million, or more than five times the cost of new automobiles. With the increasing number of cars in operation, it is fair to consider that the circulation of money, owing to the introduction and practice of the new means of locomotion, by the end of this year will represent ten times the cost of new automobiles. What this circulation of money represents, however, tells the story. In the first place hundreds of thousands of skilled workmen are employed, year in year out, at good wages. Real estate, formerly undesirable, has found a market, has been bettered and the real estate business improved. Towns and even inns lying remote from centers of population have revived and done a thriving business, whereas ten years ago they were deserted and

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their owners had no hopes for the future. Branches of insurance have been specially established and developed. Garden truck and farm products which before cost too much to haul to market, have become a paying proposition. The steel business has developed special lines. Raw material, such as wood, rubber, bronze, aluminum, copper and leather and a long list have shared in the make-up of the industry, and their cost of production and working has given employment to tens of thousands.

In the use of fire-fighting implements some experts have estimated how much quicker apparatus can respond to alarms, and have also estimated what reduction in conflagration waste would be made by using the developed machinery of the automobile, and this saving to the country at large they place at an enormous figure.

* * *

I trust that, bearing in mind the automobile as one of the greatest and newest modes of locomotion, you will not hereafter indulge for one moment in its censure when hearing of the really insignificant incidents in daily experience which are bound to go hand in hand with the development and adoption of an epoch-making phase of civilization.

WASHINGTON CAB TAXIMETERS CONDEMNED.

OFFICIAL proof of the inaccuracy of some of the recording instruments with which cabs are equipped has recently been acquired by the Washington, D. C. authorities. Eight instruments out of 45 examined were found by the city sealer to be so inaccurate as to cause their condemnation. This official measured off a straight mile on one of Washington's principal streets, and after making the road test justified or rejected opinions formed from the service test by private laboratory examination. Seals are affixed to all meters examined, that for instruments which are approved being blue in color, while a conspicuously large yellow seal is used for instruments which are condemned.

MOTOR TRUCKING OUT OF MEMPHIS.

INTERURBAN motor trucking, with Memphis, Tenn., as the center of operations, will be undertaken by a company which is being formed for the purpose. The company will also supply motor bus service, charging at the rate of 2 cents a mile, and a proportionately higher rate for shorter trips. The first service to be established will connect Memphis and Collerville, the latter point being 25 miles distant. Plenty of capital is forthcoming for the enterprise, which will at first be conducted in a modest manner and enlarged as the business may justify. Two round trips will be made daily by the trucks between the points mentioned.

The Motor Commercial Delivery Company of Wilmington, Del., has been formed with capital stock of $100,000.

Motor bus service is being supplied between Bryan and Paulding, O. The machines carry 16 passengers.

CAB ORDINANCE VETOED AND REMODELED.

AT LAST the aldermen of New York have succeeded in passing a measure regulating motor cab service, which, if it does not meet with the approval of the operating companies, at least is satisfactory to the mayor. The latter official felt called upon to veto the ordinance passed a short time ago, and sketched in the last issue of this journal, chiefly because it did not fix a standard of charges.

The new measure provides for a heavy reduction of the half-dollar initial charge which has prevailed for some months past. It prescribes that the charge for the hire of a two-seated vehicle shall be 30 cents for the first half mile, and 10 cents for each succeeding quarter mile. For four-seated machines the initial charge is 40 cents, with 10 cents for each succeeding quarter mile. The license fee for drivers is fixed at $2, and the vehicle license at $10. The waiting time charge is fixed at $1.50 an hour, an increase of 50 cents.

It is now proposed to enact a further measure which will permit but one class of vehicles to operate under special licenses, namely, those operating from garages under orders sent thereto. Such vehicles, under the provisions of the resolution to be introduced, will not be permitted to wait for fares on private stands, so-called, in front of hotels.

LITTLE MACHINES FOR MILK DELIVERY.

THE light package carrier, which is an evolution of the motor-bicycle, is beginning to make its mark in the business world. In New York City the White Cross Dairy Company uses machines of this type, which are very popular abroad, for the transportation of its half pint bottles of cream. The body, which is of sheet steel, is 22 x 24 x 36 inches. The power is furnished by a 3½-hp. motor. The walls of the body are from three-quarters to one inch apart. The intervening space is filled with a substance which does not act as a heat conductor. In the service of the White Cross Dairy Company each of these machines "performing the work of three horse-drawn delivery wagons.

MOTOR CAB SERVICE IN BUFFALO.

ALTHOUGH Buffalo is the home of the company which produced the first genuine American gasoline motor cabs, the city has never been adequately supplied with the service of such machines. With the organization of the Thomas Taxicab and Transfer Company, however, the wants of the public will be better served. It is understood that the principal stockholders of the Thomas Motor Car Company are heavily interested in the new venture, and are in fact responsible for its being launched. If this is so the public has the assurance that the machines will be unusually well maintained, while the operators will have all the advantage of knowing how to keep working expenses low. The capital stock of the company is $100,000.

The Merchants' Motor Truck Company of Cincinnati has been organized with capital stock of $25,000.

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The Morgan Company and Its Machine

The Sum of $300,000 Is Raised to Manufacture a Gasoline Truck with Unique Features of Design

IT IS a characteristic of the industry that whenever a well-designed model makes its appearance, and capital is sought for its production, the designer receives more offers of assistance from investors than he can conveniently accept. There may be a little delay in starting the enterprise, but once it is fairly launched its promoters are literally embarrassed by the riches which are placed at their disposal. This happy state of affairs is entirely due to the widespread belief in the economy of motor road transport, and it augurs well for its future.

The circumstances attending the formation of the Ralph L. Morgan Company, of Worcester, Mass., afford confirmation of these remarks. As was stated in the last issue of this journal, the company is capitalized for $300,000. Its officers are as follows: Ralph L. Morgan, president; Henry E. Whitcomb, general manager and treasurer; F. B. Durfee, vice-president; Alfred R. Grundelle, secretary. John R. Back will have charge of production. The bulk of the investment is held by Worcester capitalists. Mr. Whitcomb, the general manager, is generally considered one of the brainiest and most progressive of Worcester's business men. He is a director of the Merchants' National Bank.

The factory is three stories high, 150 by 50 feet, with a wing giving an assembly room of 350 by 60 feet. It was formerly occupied by the Crompton-Thayer loom works. The Morgan company holds a long-time lease on the property.

* * *

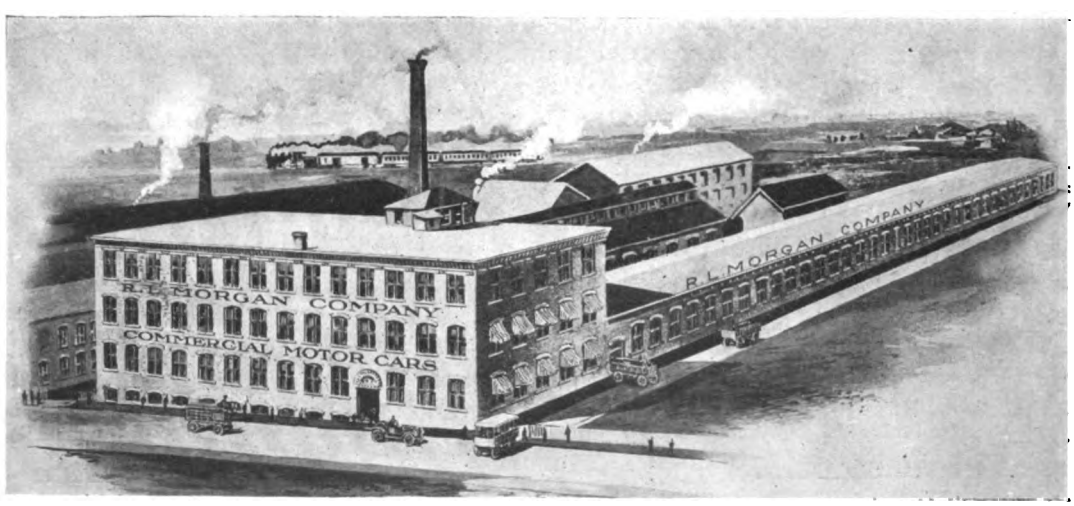
Mr. Morgan's experience in building commercial motor vehicles is very extensive. In the designing of steam-driven machines abroad he acquired high reputation, winning a gold medal for his efforts in that field of labor. He has also gained distinction as the designer of the automobile which won the Paris-New York race. In speaking of his new enterprise he says:

"The public is now well convinced of the superiority of motor trucking over the old method of haulage, and is rapidly applying its knowledge of the machine's economy. For some years past I have directed all my energy to the production of a gasoline truck that would meet the exacting requirements of commerce. The experience gained in the past has taught me some things about motor car construction which others do not seem to know. Our engine, for example, contains over 300 parts less than any other of its type built. The machine we will build will show highly refined engineering practice, and will be very durable and dependable. In every sense of the term it will be a commercial vehicle. Our engine designs, executed under my direction by B. E. Delle, are second to none, and from the time our prints were sent to the patternmakers until the completion of the patterns, not a hitch was encountered. A gentleman of high standing in the automobile field, E. J. Bring, formerly of the company for which I designed the car that won the New York-Paris race, is with us, and throughout the entire organization you will find specialists of equal ability. Mr. Back, who will have charge of production, enjoys an enviable reputation throughout the country as an economical producer of machine-made parts.

"Within a radius of 50 miles we have a population of 4,000,000 people or more. In this district there are about 160 towns and cities, each containing 5,000 or more inhabitants. The road system throughout New England is incomparable, and is constantly being bettered. This makes for our section the greatest possible field for the sale of commercial cars, and it is an interesting fact that one-fourth of the automobiles manufactured in this country are sold in New England. There is hardly a town, if indeed I may make any exception, that is not intercommunicative with others by a splendid road system, and all this augurs a large use of motor trucks."

* * *

The Morgan truck is rated to carry four tons. It is fitted with a four-cylinder engine which is capable of developing 50 hp. Its rating, however, is 40 hp. It is extremely light, weighing from 100 to 200 pounds less than



Plant of the recently organized R. L. Morgan Co. at Worcester, Mass.

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other 40 hp. motors. The countershaft is one of the machine's interesting features. It can be locked at will. The compensating gear is made idle by inserting a one-inch pin in the Vernier lock which is outside one of the minor sprockets. The locking is instantaneous. The countershaft is mounted on spherical bearings attached to the side frame members and, owing to its construction, the twisting of the vehicle frame from time to time in no way affects the alignment of machinery. The advantage of this lock-countershaft construction is paramount when one wheel of the truck slides into a mud hole, because the moment the locking is effected both wheels get equal traction. Consequently the truck needs no assistance when mud holes are encountered.

The total length of the Morgan truck is 14 feet; width, 6 feet; wheel base, 108 inches; gauge, 60 inches; gasoline capacity, 25 gallons; driven through double chain; rear axle is solid; clearance under front axle, 14 inches; clearance under rear axle, 16 inches; speed change gear, planetary or epicyclic; two speeds forward, one reverse, operated by single lever; throttle controlled by lateral slide foot lever; speed under maximum load, 10 to 12 miles per hour.

The engine is of the four-cylinder, vertical type, cylinders cast in blocks of two, with water jackets integral; clutch, multiple disc; valves, flat type, made of nickel steel; crankshaft and countershaft, nickel steel; engine is enclosed in unit aluminum shell, with oil pan at bottom; inlet and exhaust operated by single cam shaft.

The steering gear is of the pinion and sector order. Internal expanding brakes are fitted to the rear wheels, the diameter of the drums being 18 inches, with 4-inch face. The frame is made of 6-inch channel steel. The front axle is of 4-inch I-beam pattern. The rear axle is 3¼ inches round. Wheels are made of pressed steel. The standard gearing is 9 to 1 on high and 27 to 1 on low and reverse. These ratios can be changed to suit varying service conditions.

Starting is automatically accomplished by means of magneto ignition. The starting device in its action retards the first spark produced when the engine is being cranked, always firing a charge after dead center has been passed. When the first spark has been produced the magneto instantly assumes normal position, and is then ready for regular running. By the use of this magneto it is possible to start the engine of the Morgan truck with a half turn of crank, turning the latter as slowly as may be desired. The time saved in the aggregate through quick starting justifies the fitting of this expensive magneto.

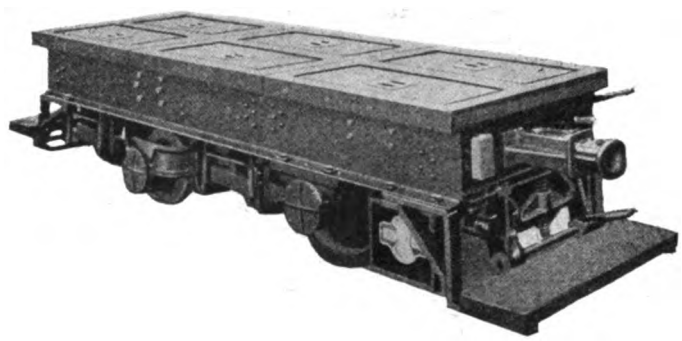
MAY ESTABLISH PLANT IN ESCANABA.

EFFORTS are being made to establish a plant for the manufacture of commercial motor vehicles in Escanaba, Mich. The Business Men's Association of the city is considering a proposal from D. C. Denison, president of the Denison Motor Company, who asks that the citizens subscribe for $50,000 of stock in a company to be capitalized at $200,000.

ELECTRIC TRUCK FOR SHOP USE.

THE traveling overhead crane is a very useful piece of apparatus, but a mechanically driven factory floor truck may easily prove much more serviceable in a great many establishments. The Westinghouse company is so well assured of the correctness of this observation that it intends to produce storage battery trucks of various large capacities. It has satisfactorily tested a 10-ton machine in its own plant in Pittsburg, using it to transport castings and other heavy loads about the big building.

This truck is mounted on four wheels whose two axles are gear-connected to spring-suspended motors. An angle-iron cradle carries the batteries. At the operating



Westinghouse 10-ton swivel base storage battery truck.

end of the truck are mounted the controller, brake, charging receptacle, cut-out switch and voltmeter. The deck, which is clear of all machinery, is made in sections that can be taken up so that any part of the apparatus can be easily examined. The motor is capable of standing heavy overloads, and is dust-proof and self-oiling. The controller gives four speeds in either direction, and is provided with an interlocking reverse lever to protect the motor and battery against premature reversal.

The storage cells have been designed to permit high rates of charge and discharge without injury, making possible a greatly diminished weight of battery in instances where a part of the working time is available for charging, as is usually the case in this class of truck service. The operation of charging has been so simplified that the truck can easily be charged during idle periods.

The high efficiency of the truck is demonstrated by performance, which averages 700 ton-miles of service per month with an expenditure of 63 kilowatt-hours.

This Westinghouse truck is made in ten, twenty and forty-ton sizes, for various gauges from standard to 18-inch.

MOTOR BUS PERFORMS STRANGE WORK.

HAD it not been for the timely service of a motor bus owned by the Auto Transit Company, of Wyalusing, Pa., the neighboring village of Camptown might not be in existence to-day. A disastrous fire threatened and no fire apparatus was at hand. In this emergency the motor bus was dispatched to Wyalusing, from whence it towed a hook and ladder vehicle, usually pulled by horses, enabling twenty-three firemen to go into action and extinguish the flames.

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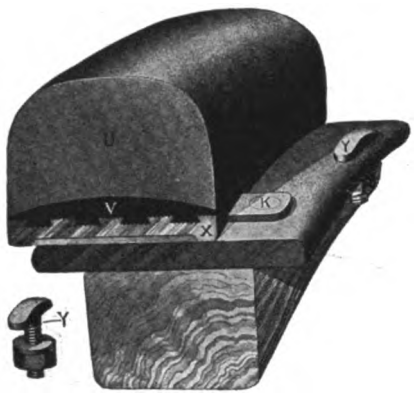
THE GOODRICH "WIRELESS" TRUCK TIRE.

A VERY active demand exists for the new Goodrich "wireless" truck tire. The construction of this tire affords certain advantages which are to be found only in it. It consists of three integral factors: a special steel base with dove-tailed grooves on the top surface; a hard rubber sub-base, which is inseparably united with the steel base; and a soft rubber tread or tire proper, inseparably vulcanized upon the hard rubber sub-base. The tire is mounted on a special steel rim, or felloe band, which projects far enough on either side to protect the rubber from jamming



against curbs, etc., in service. It is held in place on this band by means of lug bolts on either side of the steel base, and a key on the felloe band which fits into a key-seat on the inside of the steel base of the tire, thus preventing circumferential movement. The fastening point of the tire is steel to steel, and is, therefore, absolutely secure.

The advantages afforded by this construction are: First, increased mileage, because the tire will stand a maximum external abrasion without affecting its fastening to the wheel; second, freedom from repairs, because there is no hinging action of the rubber over internal metal fastenings; third, decreased cost per mile, as a result of the first two advantages. No complicated machinery is needed to apply the tire. It may be quickly and easily put on any wheel which has been properly equipped with the "wireless" rim.

The "wireless" dual type offers, perhaps, the most unique advantages. The improved construction makes it possible to set the twin tires on the rim in direct contact with each other. This reduces the space between the tires to the minimum necessary to prevent skidding and displacement of the rubber under stress. The narrower tread also reduces the necessity for offsetting the felloes on the drive side, and enables the load to be distributed centrally over the hub and spokes.

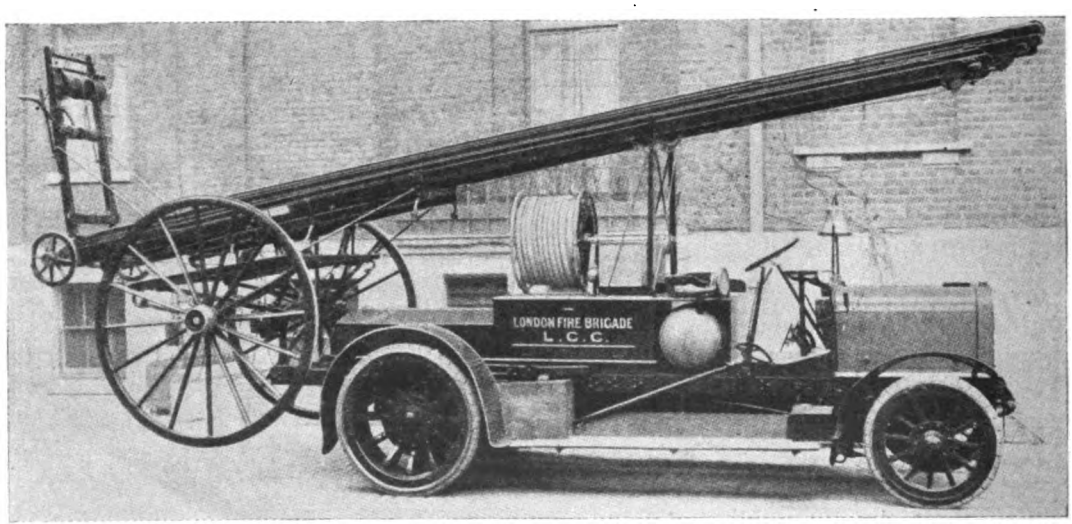
REACTIONARY SENTIMENT.

THE opponents of sound public policy are by no means so few or so powerless as to be disregarded. They have always existed in large numbers, and it is likely they will persist to the end of time. Their chief use is to steady enthusiasm and prevent the acceptance of reform proposals before they are well matured.

But while one is prepared to admit the economic use of the obstructionist, whose acts usually proceed either from ignorance or interest, it is disconcerting to learn that some of the breed actually consider the superior protection of human life and property as extravagant. One would think that the wish to live in security was fundamental in the race. This conclusion is not sustained upon reading what follows:

"As the crowning act of extravagance, it is proposed to spend $4,500 on the purchase of a motor fire truck that is about as badly needed as a roof garden on the city building. What becomes of our boast of the efficiency of our fire department, if there is such a sudden and pressing necessity for a motor truck? No piece of apparatus has been destroyed, or taken out of commission, and we have pointed proudly for many years to our small fire loss."—*Wheeling (W. Va.) Register.*

The fault of this protest is its absurdity. If in the past Wheeling's fire loss has been small owing to the installation of useful apparatus, it will be smaller if the equipment is improved. The maintenance of adequate fire protection can never be considered municipal extravagance. The lack of it might.



One of five machines recently installed in London, fitted with four and six cylinder engines rated from 25 to 50 hp.

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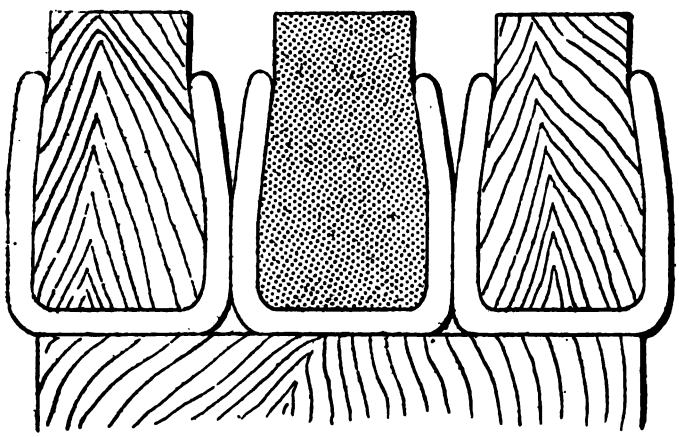
MIXED WHEEL TREAD.

EXPERIENCE has shown that no substance is better than rubber for a wheel tread on motor wagons engaged in light or heavy duty. This is especially true if the vehicles are run over surfaces which occasion side slip. The relatively high charge for such equipment, however, has led many to resort to the use of makeshift devices which, while possessing the merit of low first cost, do not afford the cushioning properties so necessary for the protection of the superimposed mechanism.

Slow moving heavy vehicles, operating on country roads, may be equipped with a mixed tread such as is



illustrated, but it is quite certain that it would neither prove economical nor practicable in city service where higher speed is required. The device has some slight vogue abroad. Its three steel rims are shrunk on the wooden felloe. Two side blocks of hard wood and a central block of rubber are fitted to these rims. When new the wood blocks project slightly above the rubber.

RAPID PLANT AGAIN TO BE ENLARGED.

AGAIN it is necessary to enlarge the plant of the Rapid Motor Vehicle Company, the recently erected quarters not being adequate for present needs. The company has decided to construct a two story building which will be 640 feet long and 60 feet wide, giving 76,800 square feet more floor space. This new building will be built of reinforced concrete.

Arrangements have been completed for motor bus service between Las Vegas and Santa Rosa, and the former point and Mora.

Motor cab service is to be furnished in Nashville, Tenn., by a company which has been formed with capital stock of $30,000.

Five motor wagons are operating in the service of the Chicago public library. Last year they carried 662,986 books, which is about 100 per cent more than the five horse-drawn delivery wagons which the machines superseded were capable of hauling. The machines operate between the main library and the substations numerously scattered throughout the city.

THE WAGES OF DRIVERS.

IN ESTIMATING the wage which should be paid to motor wagon drivers there are several very important elements to be considered, namely, the load, the competence of the men, and the character of the duties they perform.

If a driver is selected for his known ability to care for as well as steer a machine it would be reasonable to expect that he should be rewarded at a higher rate than one who merely discharges road duties. Furthermore, if he must handle loads his work in this respect will be proportionate to the rating of his machine, and if the merchandise is heavy he should be correspondingly compensated. As the cost of maintenance is largely dependent upon the skill of the operator it is evidently well worth while to keep him at his best by paying him what he is worth. Poorly paid drivers cause heavy loss, as they are usually incompetent. This latter point is nicely established in the following communication:

"*To the Editor*—Having decided upon the type and rating of motor wagon best suited for his business, the merchant should exercise much care in the selection of the driver, especially if he is to look after the machine. Except in such establishments as have the benefit of the service of a well organized force of stablemen, under the supervision of a skilled engineer, the success of the motor truck rests entirely with the driver. Few concerns can afford to employ extra men if they only operate one or two machines.

"The idea is prevalent that most anyone can operate a motor truck, and I am sorry to say that it is being advanced by many who are selling machines. In many cases it is put forward in ignorance; in others it is used to establish a theoretical low operating cost. Those in charge of steam engines, locomotives, power plants, elevators, etc., are all men of experience who thoroughly understand their business, and are capable of either making replacements or instructing others how to do so. There is no reason why the motor truck, which is subjected to rougher usage, should be operated by people devoid of intelligence. In all my experience with the users of motor trucks throughout the country I have found that, except in a few instances, most of the troubles encountered were blamable to the low paid man on the box.

"There are many excellent machines built, but the best of them cannot withstand the harsh treatment of inexperienced and incompetent drivers. The persistent advocacy of a low salaried driver is not undertaken in the interest of the merchant, who cannot afford to employ any but good men. A gasoline truck driver at ten or twelve dollars a week is too expensive a luxury for any concern. The capable man earning twenty or twenty-five dollars, or possibly more, is like an insurance policy guaranteeing low operative cost and satisfactory service. The poorly paid driver will run up bills for hundreds of dollars worth of broken parts and time for replacements; the good driver, on the contrary, is rarely ever held up and the repair bills for his machine are very small.

C. E. STONE"

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GOSPEL MOTOR WAGON PUT IN SERVICE.

LAST month mention was made of a gospel wagon which was being constructed for service in the factory of the Rapid company. The machine was purchased by T. A. Snider, head of the Snider Preserve Company, of Cincinnati, and by him turned over to a noted traveling evangelist. The machine was shipped to Middletown, Ohio, where it was first put to use. Thirteen years ago Mr. Snider donated a horse-drawn vehicle for a similar purpose and the good work accomplished by the evangelist who made use of it suggested the idea of presenting a modern vehicle for similar service. The evangelist in charge of the machine is Miss Anna L. Cartwright, who is assisted in her work by musicians and speakers.

ANOTHER COMPANY TO MANUFACTURE TRUCKS.

EARLY last month the Custead Motor Company was formed to manufacture machines in Pittsburg. The capital stock of the concern is $100,000. Its securities are principally held by capitalists in New York City, Tampa, Fla., Alverado and Waco, Tex. The central figure in the company is William D. Custead. The models to be manufactured will contain many novel features which, it is expected, will soon be described and illustrated in this journal.

ADDITION TO RANKS OF CAB MAKERS.

A FACTORY which from the time of its equipment will employ 200 workmen will be constructed in Memphis, Tenn., for the erection of the Corbitt Taxicab Company's vehicles. This project has languished on account of the illness of the president of the company, M. S. Corbitt. The manager of the company is Benjamin Peebles.

Motor bus service has been commenced between Cadiz and Wheeling, O., connecting Dillonvale, Mt. Pleasant, Harrisville and Martin's Ferry.

ORPHANS' RIDE IN MOTOR TRUCKS.

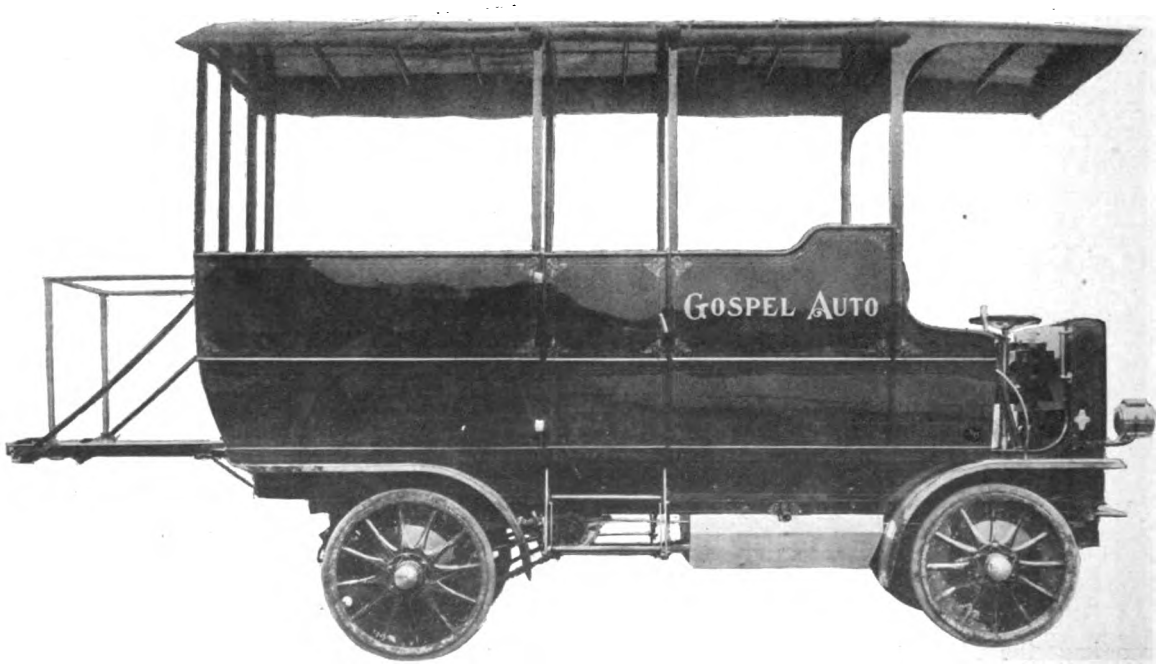
ONE day last month the orphans of the New York schools to the number of 2,000 were given their annual ride to Dreamland, Coney Island, upon which occasion a number of motor wagons were pressed into novel transportation service. Among the machines so utilized

Frayer-Miller truck loaded with orphans.

was a 3,000-pound Knox wagon, a 3-ton American Locomotive truck, two 3-ton Plymouth machines, a 3,000-pound De Dion wagon and a 3-ton Frayer-Miller model. The latter machine carried 46 youngsters, occasionally making a speed as high as 30 miles an hour. Sight-seeing cars, taxicabs and buses were also conspicuous in the parade.

ANOTHER CAB COMPANY FOR MEMPHIS.

ANOTHER motor cab company has been organized to operate in Memphis, Tenn. It is known as the Taxicab Company of Memphis, and is registered with capital stock of $100,000. The new concern will commence operations with 25 machines.



Gospel Wagon used by Traveling Evangelist.

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Truck

It isn't a question of Yes or No, but **Which.**

The motor truck has come to stay. It is a recognized factor in the economic conduct of modern business.

The Mitchell Truck comes to you with all the prestige of the name of Mitchell.

The entire output of Mitchell pleasure cars for 1909 was taken **before the year began.** Our immense plant is now running overtime to meet deliveries.

The Mitchell Motor Truck has every feature of excellence, of material, skillful designing and expert workmanship that has made the Mitchell line famous.

As that word "famous" is a much abused term, let us explain by saying that more Mitchells are sold today than any other high-grade American car.

Write and ask us about the Mitchell Truck. Ask us about the 1169-mile trip with a 3400-pound load over the most abominable roads, at an expense of only $39.40 for gasoline, oil and grease.

Let us tell you about the improvements we have made in this truck since then.

A 4-cylinder truck—20 horse power—ton-and-a-half capacity—price $2,000.

For full information write Mitchell Motor Car Co., 568 Mitchell St., Racine, Wis., Standard Manufacturers A. M. C. M. A.

European Branch: No. 20 Rue de Tilsitt, Paris, France.

Mitchell

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Wagon Maintenance

Tips to New Drivers and Caretakers About Things Which Are Likely to Escape Their Attention

SIGHT feed glasses often become coated with oil on the inside, preventing the flow of oil from being observed. It often is difficult to dismount them. This is not necessary, for if the glass be warmed with a lighted match, not held so close as to crack it, the oil will run down from the walk. Or slip a stout cord or strip of cloth around the tube, and draw it rapidly back and forth, thus generating by friction sufficient heat to loosen the oil.

* * *

Use Care in the Selection of Lubricating Oil.

Many vehicles are ruined through the use of cheap and deleterious lubricating oils. The purpose of lubricating oil is to reduce friction, and to the extent you are able to reduce this friction you save power and prolong the life of your vehicle. Few exercise proper care in the selection of oil. The majority purchase the cheapest obtainable. An owner should select a good lubricating oil—one that will never go back on him. He will note the satisfactory results at once, less carbon and greater lubricating qualities. From 20 to 35 per cent of the power between engine and drive wheel is lost by poor lubrication. "Quality counts" is an old saying, and its truth was never better demonstrated than it is in the lubrication of a motor car. It is not how much oil you feed that counts. Success of lubrication depends on quality, not quantity. Often the owner of a car will complain of cut bearings when his lubricator has never failed to work and his crank case has always had sufficient oil to keep the bearings from becoming dry. The fact of the matter is his oil has been carbonizing, and small flakes of hard carbon have been dropping into the crank case. Minute particles work their way into the bearings and grind them out as quickly as if emery had been placed in the crank case. While all oils contain carbon, yet, if the oil is of the right quality and has been refined scientifically, this carbon will burn with a perfectly dry ash, which will discharge itself through the muffler, and no bad results will be obtained from its use.

* * *

Some Sensible Injunctions.

Don't permit any old ignition wire (cable) to be used in wiring your engine. Examine each piece of cable carefully and see if there is a break at any of the sharp ends. Rubber cable is best, because it will reveal cracks caused by age.

Don't test dry batteries with a volt meter, or you will burn them out. The ammeter is for testing dry cells and the volt meter for storage batteries.

Don't think that the more juice turned on, the better and faster the vehicle will run.

Don't crank your engine with the spark advanced. Hundreds of arms are broken yearly through this mistake.

Don't get rattled at an explosion in the muffler. It indicates weak batteries, lack of gasoline, poorly adjusted coil or stopped-up carburetter.

Don't let your motor pound. On hills this is generally due to spark lever being too far advanced. If retarding lever does not remedy the fault it may be in loose crank bearing, loose piston bearings, loose main bearings, or loose flywheel. Pounding can do great injury to a motor in a very few minutes and should be remedied at once.

* * *

Proper Method of Holding Starting Crank.

There are two ways of gripping the starting crank. Only one is safe. Ordinarily the driver grasps the handle with a firm grip, with the fingers wrapped around it in one direction and the thumb around it in the other. If the motor backfires the position of the thumb prevents letting go quickly enough to be of any service. The proper way is to take hold with the fingers around the handle, but never tightly. The thumb should not be used at all, but should be folded back alongside of the first finger and out of the way. The whole work is done by the fingers, and if anything happens the backward action of the crank simply opens the closed fingers and no harm is done. This particularly holds true when taken in conjunction with left-hand starting. In that case the latter and dangerous part of the starting action is a pull toward the operator. The arm is in tension, in which the greatest strength can be exerted. So, if the engine backfires, a person just stands still and holds the arm taut, while the backward action of the engine opens the hand and then rotates harmlessly.

* * *

Simple Method for Testing Engine.

By placing the hand on the bottom of the radiator, the running condition of the engine can be accurately noted. If the radiator is unusually hot it may be due to lack of water, choked water pipes, insufficient lubrication or from running the motor on open throttle with a late spark.

One of the drivers employed by the Indianapolis postal motor service has been arrested four times for speeding.

At present there are about 12,000 motor wagons in use in England.

A company has been organized to operate motor buses from Greenfield, Mass., to Turners Falls and Northfield.

Drivers of New York motor cabs are not permitted to solicit fares except at stands where they are regularly stationed.

The Taxicab Livery Company has been organized in Milwaukee with capital stock of $25,000.

The mayor of Boston has authorized the award of a contract for the purchase of a motor hose and chemical wagon costing $5,700.

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The Power Wagon

A Journal for Those Employing Commercial Motor Vehicles

No. 57 AUGUST, 1909 No. 57

PUBLISHED THE FIRST OF EVERY MONTH BY

THE POWER WAGON PUBLISHING CO.

SUBSCRIPTION RATES:

One Year (Domestic)	$2.00
One Year (Foreign)	3.00
Single Copies	.20

PUBLICATION OFFICES:
THE METROPOLITAN BLOCK
Chicago, Illinois.

Advertising Rates on Application

WALTER WARDROP, Editor

Entered as Second-Class Matter December 2, 1907, at the Postoffice at Chicago, Ill., Under the Act of Congress on March 3, 1879.

Horse Breeders Are Uneasy

They vainly endeavor to influence public opinion by circulating false reports of large sales.

THE practice of circulating stories which have no basis in fact, either as a means of stemming public opinion or for diverting its current, is very doubtful commercial diplomacy. It is the last resort of the hard pressed. Draft animal breeders, alarmed at the progress of mechanical road transport and greatly dreading its eventual effect upon their industry, are very skillful in practice of this sort, never missing an opportunity to magnify the credit of their own calling or to impair that of the motor wagon.

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The most recent example of this discreditable policy came to light in New York, where it was rumored that 840 animals were immediately required for department store service. To give relish to this yarn it was said that the establishments needing such equipment had decided to abandon their machines.

Diligent search not only failed to uncover a buyer for so many animals, but actually proved that the big houses using motor wagons are quite well satisfied with their service. As, however, the investigator was a representative of the horse breeding interests, he could not very well submit a report confirmatory of the latter discovery; so he ingeniously contrived to make it appear that the machines are merely retained because it is inconvenient to get rid of them. In one establishment the visitor was told that five motor wagons purchased three years ago were now exclusively employed in long haul work. At first they were assigned to short haul duty. The original misapplication is not explained, but its detection is exploited as a victory for draft animal transportation!

Petty discoveries of this sort comprise a large part of a rather elaborate attempt to make it appear that the machine is not holding its own in competition with the horse.

With this barren triumph to fortify him the investigator proceeded to another establishment, where it was learned that six machines were in operation, having been installed three years ago.

"This firm is still using these machines," it is confessed; "but only for the reason that it has them on hand and is unable to dispose of them at satisfactory prices."

One with less prejudice than the horse breeders' representative might hazard the opinion that the machines operated by this firm are retained because their service pays. Big business houses do not knowingly incur loss which can easily be avoided. They do not maintain museums of mechanical miscellany.

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In an inconspicuous part of the report it is related that the manager of one concern which employs 342 delivery wagons, 31 of which are motor driven, favors the service of machines as soon as it can be demonstrated that they are capable of better work than horse drawn wagons. This muddy statement is somewhat clarified by the assertion that 13 of the 31 motor wagons have been bought within the past sixty days. What the management really thinks of the service of machines is perhaps best expressed by its most recent action in relation thereto.

Every place the investigator went the same conditions were encountered. Wherever the machines had once been intelligently applied they were firmly established.

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The achievements of the motor wagon need not utterly discourage horse breeders. If they will but pause to consider that the machine is not a substitute for draft animals in all classes of work, that, in fact, its economy is very largely governed by the opportunity which is afforded for exercising its superior speed, range and load capacity, it will be noted that there still remains a large field of operations for the inferior horse. The length of time it is possible to keep trespassers out of this field will be determined, not by barking, snarling and snapping at them, but by improving the breed of drafters and, possibly, selling them for less money than they command today. In active competition with the motor wagon, in service suitable for the machine, the horse has no more show than a man with tallow legs in Zanzibar.

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A PROPHET OF DESPAIR.

WRITING from Paris to the "Breeder's Gazette," a correspondent who blushes to acknowledge that his expectations were once mildly stirred by the posibilities of the motor wagon now desires all and sundry to forget that he ever betrayed such weakness. Double apostacy of this sort is so rare that the horse breeders' organ gladly makes the most of it, doubtless believing that in so doing it is rendering its clients a valuable service. The text of the recantation follows:

"I have always taken an interest in the motor wagon for hauling, thinking it was only a matter of time till it would affect the draft horse industry of America. Our breeders can go on producing drafters with confidence that it will not be in their time, nor the time of their grandsons, that draft horses will not be needed. France leads the world with motors and electricity and made a total failure when it came to the heavy motor wagon. The last effort died out with a couple of wagons constructed eighteen months ago. In their first public trial they stalled on very slight grades, broke in the streets and all the street car tracks they crossed. Then the Paris city authorities forbade their further use. They were sold to a Brussells syndicate with the same results. The machines were finally sold to the Congo, and that is the last heard of them.

"It seems impossible to construct wheels to stand the weight. If the streets and roads first constructed by the Romans in these old countries, and improved from generation to generation, cannot support these heavy haulers, what can be expected in a new country where, we might say, we have no roads only what nature has given us, with a foot of sand and gravel dumped on top of a six-inch grade of dirt, and with state laws to prevent heavy hauling in the spring?

"A. G. THOMPSON."

Obviously this criticism refers to some monstrous design intended to bear a great load. It certainly cannot be applied to machines of 3 or 5-ton rating, which are in successful operation everywhere throughout the civilized world.

One suspects that both the correspondent of the horse breeders' organ and the journal itself are rather too anxious to have public opinion with them in this matter, and that the affectation of "interest" in the development of the motor wagon is merely a convenient disguise for the dread they entertain of it. Just as drowning men catch at floating straws, so this horse breeding critic—for such he evidently is—seizes some trivial incident in the practice of modern road transportation and attempts to buoy up his hopes by magnifying its importance. Road crushing motor trucks are unknown in this country and it is hard to credit that examples of the type are common in Europe.

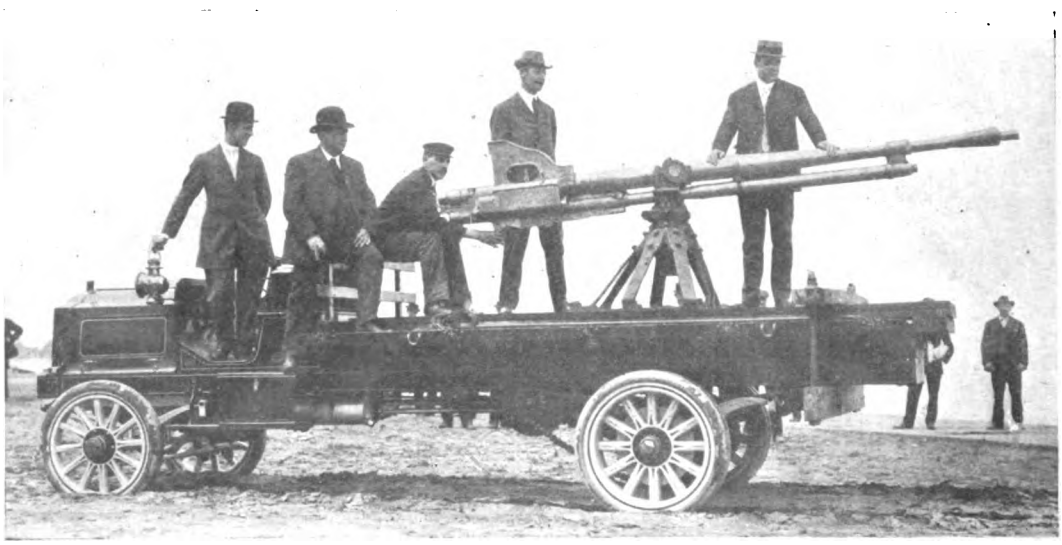
Mr. Thomson is a shallow observer if he has not noticed the rapid growth of heavy motor trucking both at home and abroad, and if he can manage to survive a few more years he will again have an opportunity for revising his opinion. The grandchildren to whom he so feelingly alludes will doubtless laugh uproariously at the prediction of their foolish progenitor who apparently has difficulty in seeing farther than the end of his nose.

It is also worth while remarking that France is not by any means first among the nations which are developing motor road transport; in fact, it is very far behind America, England and Germany in this respect.

RAPID FIRE GUN ON MOTOR TRUCK.

THE largest automatic gun in the world was tested recently at Cleveland, being mounted on a Packard three-ton truck. An ordnance department officer and Dr. S. W. McClean, designer of the gun, had charge of the tests, being assisted by the Standard Automobile Company, Cleveland agents for Packard trucks.

The gun fired three-pound shots at the rate of 100 per minute, the range being 3½ miles. Shots were tried with the brakes of the car set and released. When the brakes were set the truck did not move and no shock was felt by those surrounding the gun on the truck platform. With the brakes released there was a slight movement on the recoil, but no shock. The designer of the gun recommends its use on motor trucks armored for war purposes.



Packard Truck Equipped with Rapid Fire Gun.

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MAIL COLLECTION AT THIRTEEN CENTS A MILE.

IN the comparatively few instances in which motor wagons have been used in postal work it has been demonstrated that their service can be procured for less money than horse-drawn vehicle contractors are accustomed to ask from the government. This is notoriously the case in the motor collection service authorized in Detroit and Milwaukee, maintenance particulars of which have been supplied in past issues of this paper.

But it is not alone the economy of the machines which urges the federal authorities to encourage transportation of this character. The expediting of collection and delivery is a matter of so much importance that, even if the service of motor wagons could not be obtained for less than that of the regulation horse-drawn screen wagons, it is probable their employment would be tolerated. Postal business is increasing at such a rate that the government perceives the necessity for making use of the most modern means of transportation to facilitate dispatch. Hence, the use of pneumatic tubes and street railway cars, both of which are provided at very high cost.

It is not an easy matter, however, for the government to connect with individuals or companies willing to make trial of the motor wagon in postal service. In a few cases where the machines have been so employed dissatisfaction has resulted both to the authorities and the operators. This state of affairs, however, grew out of a want of proper apprehension on the part of the operators, who were profoundly ignorant of the maintenance charges until after the machines had been in service for some time.

That the postal authorities are still the patrons of the motor wagon is well proven by their recent acts, the most noteworthy of which was the awarding of a contract to a motor mail-carrying company in New York calling for the service of 14 machines. Another evidence of the government's liking for the motor wagon is evident in the neighborhood of Boston. Readers will recall that an experimental service was established some time ago in Newton, which is a suburb of Boston. It has been operating so smoothly as to give occasion for the signing of a contract calling for 38,350 miles of travel a year at the rate of 13 cents a mile. The contract dates from April 1, when the experimental service was commenced. One steam wagon is used. It makes two collections daily. In the morning the boxes are collected, the mail sorted, and en route to the Boston postoffice the mail is left at the nine stations for delivery on the first afternoon routes. At night there is another collection, the mail being sent out on the first morning delivery. The system has been very satisfactory and has greatly facilitated the delivery in the Newtons. As a result of it, Postmaster Mansfield is considering measures to extend it throughout the Boston postal district.

The town of Hull, Mass., has contracted to buy a motor fire vehicle for $8,000. The machine will carry a crew of seven, two ladders and 1,000 feet of hose.

MOTOR CYCLES IN FIRE SERVICE.

PROCEEDING upon the theory that it is better public policy to attempt the suppression of fires before they gain headway than to combat them after they have destroyed much valuable property, the authorities of Buffalo have for some time past been experimenting with motor cycles equipped with chemical extinguishers.

The successful use of these little machines gives rise to the thought that eventually they may be much more extensively employed than at present, and that perhaps the whole character of fire department equipment may undergo a radical change at least so far as the fighting of small fires is concerned. It is not more absurd to send a motor hose and chemical wagon to the scene of a distant fire which never promises to be dangerous, than it would be to dispatch a battleship upon a mission which might be satisfactorily performed by a unit of the mosquito fleet. There is also to be considered the congested condition of the roadways. The little machine can wind its way through traffic which would seriously impede a larger vehicle.

There is hardly less reason for supposing that motor-driven fire apparatus should all be of the heavy order than there is for imagining that heavy trucks are likely to have a monopoly of light parcel delivery. The character of service to be performed in each case will eventually determine the type of machine to be employed.

Of fires recorded, fully 90 per cent are what the brigade men term "lace curtain affairs." That is to say, their origin is obscure and their character insignificant. The Buffalo fire chief very properly regards alarms of this description as too unimportant to demand a turn-out of the heavy vehicles and their crews. Instead he dispatches one of the light and speedy motor cycles, equipped with two chemical extinguishers on the rear wheel, and he finds that they render all the aid that is necessary. The extinguishers are held in position by means of vertical springs.

A rural mail carrier residing in Acton, Indiana, is covering his 25-mile route on a motor bicycle when the condition of the roads will permit. Last year he made 158 trips on his machine.

Efforts are being made to provide Peoria with electric bus service in districts not now traversed by trolley cars.

The Plainfield (N. J.) Motor Bus Company has been incorporated with capital stock of $50,000.

Carlton, Flat Rock, and Rockwood, Mich., will probably be connected by motor bus.

The Auto Transfer Company has been licensed to operate in North Wilkesboro, N. C.

Seven cotton yarn salesmen in Philadelphia use automobiles in their business.

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Five-ton Trolley Truck Operating Off the Track.

Independent Rail Vehicles

Electric road and rail trucks ordered by eastern traction company—Gasoline rail bus design.

IT CAN hardly be doubted that the independent motor rail vehicle, whether driven by gasoline or electric power, is superior to many rival forms of locomotion. Furthermore, if the electric form of this type is equipped to operate on road as well as track, it should, within certain limitations, prove a formidable competitor of vehicles which are designed for exclusive road or rail service.

There are many who predict that the city street car of the future will be a vehicle independent of power station. The reasons adduced for this opinion are as numerous as they are obvious. It is also extremely probable that such a vehicle will in due process of time serve all sparsely settled regions where infrequency of service makes the present style of steam or electric equipment too expensive to maintain. Experiments conducted by the Union Pacific railroad long ago confirmed this opinion of the practicability of such a vehicle for such work.

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In a recent issue of this journal it was related how electric trolley bus and wagon transportation had become established in Europe and how it was about to spread to England. It now seems that these undertakings but briefly anticipated enterprise of similar character in this country. Two 6-ton electric trucks have been ordered by the United Traction Company, of Albany, N. Y., from the Trolley Vehicle Company of America, with headquarters in Philadelphia. Although these machines will chiefly operate on street car tracks, they can, owing to their equipment with storage batteries, also travel on the road. They will not, however, depart from the fixed rails unless it is necessary to do so for the convenience of passenger traffic. The machines will be employed in hauling coal for the traction company, which annually requires about 40,000 tons of this commodity for its own use. For some years experiments have been conducted with this type of machine in Philadelphia and Pittsburg, the hauling of traction company freight being the object for which the early models were constructed. The placing of this order is the first sign which the traction world has given of its approval of vehicles of this type.

Urban and interurban trolley line companies have lately been attentively studying the possibilities of carrying freight as well as passengers over their tracks. The possibilities for freight hauling are enormous, and at every convention of trolley line operators the subject is warmly discussed. The opinion is general that the hours of the night could be more profitably employed in hauling freight than are the hours of the day in transporting passengers. The notorious slowness of steam railroad traffic is the basis of all conjecture concerning the future of electric trolley freight transportation.

Electric rail transportation experts witness with considerable chagrin the utilization of their tracks by every form of vehicle which plies the road. This is a public convenience for which no toll can be collected, though it causes very considerable expense to those who are bound to keep the tracks in good order. In effect, electric railroads have no control over their roadbed except when they own the right of way.

* * *

Broadly speaking, one electric trolley truck, equipped with storage batteries for occasional road service, is equivalent to three horse-drawn vehicles. The mere statement of this ratio is enough to establish the economy of the rail and road machine, the speed of which on the road averages between six and eight miles an hour. Such a

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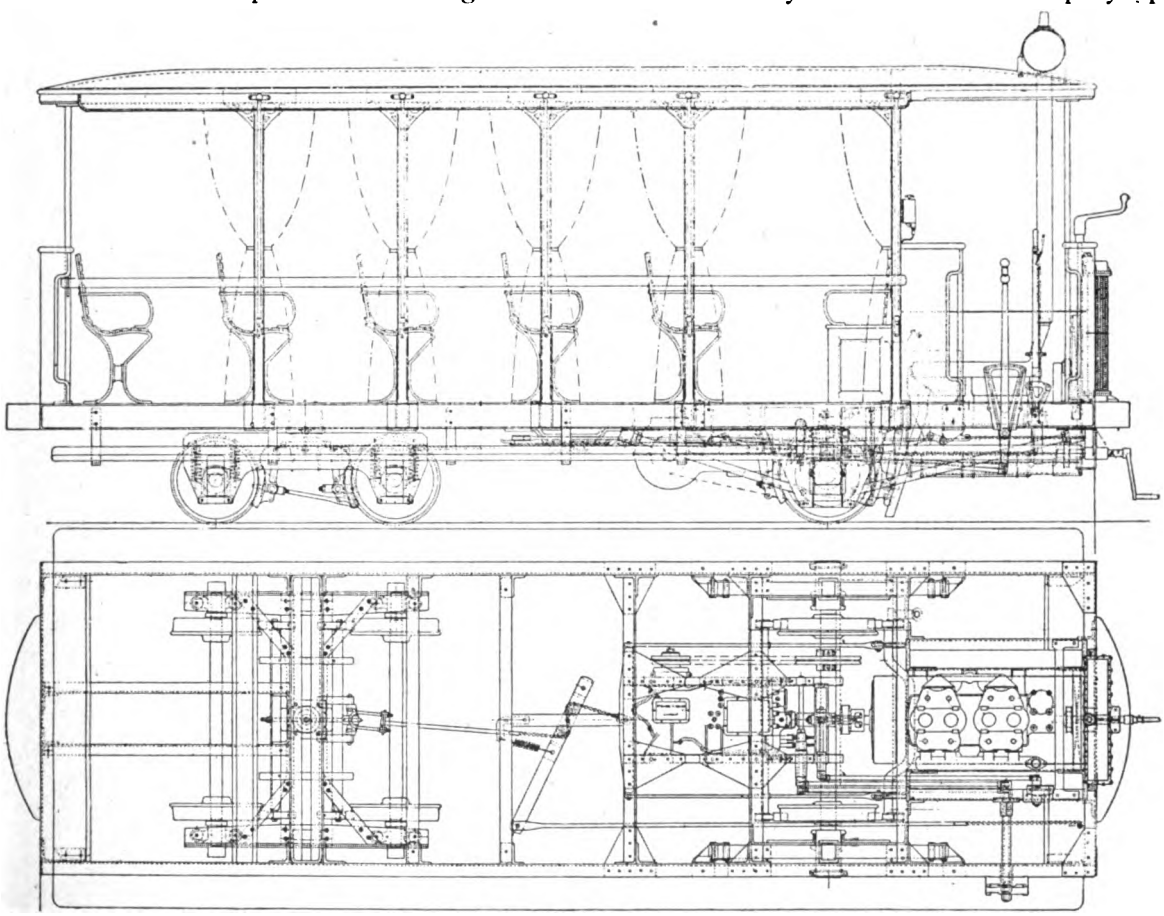
vehicle has distinct opportunities in the performance of municipal work, such as the sprinkling and cleaning of streets, the removal of ashes, snow and garbage, and, under certain circumstances, the performance of police ambulance and fire service. It can be employed in hauling traction company freight, general merchandise, express matter, package, mail and so forth, all of which can be transported at comparatively little cost. Its radius in service is the extent of the trolley rail system plus the mileage of its storage battery. It can travel faster on rails between terminal points than a regular trolley car, as it is not required to stop for the picking up or discharge of passengers and consequently can overtake passenger vehicles and, by means of its independent power plant, get ahead of them. All these are reasons why the makers of independent rail vehicles, equipped for road service, urge the formation of companies for the operation of such machines, special stress being laid upon the freight which can be moved at night when few passenger cars are in service.

* * *

During the night hours electric transportation lines lose heavily. There is a period of about seven hours in every day throughout the year when passenger car service is very light. Seven hours a night for every day in the year gives 2,555 unprofitable hours. There are 8,760 hours in a year, and as 2,555 of them is equal to over 29 per cent of the total time, the latter figure represents the waste on every trolley ssytem in the country. To turn these waste hours into profitable working hours would seem to be a matter worthy of the closest attention of electric line administrators.

Another View of Trolley Truck Operating on Roadway.

The Trolley Electric Vehicle Company's product, as



Elevation and Plan of 32 h.p. Gasoline Rail Bus.

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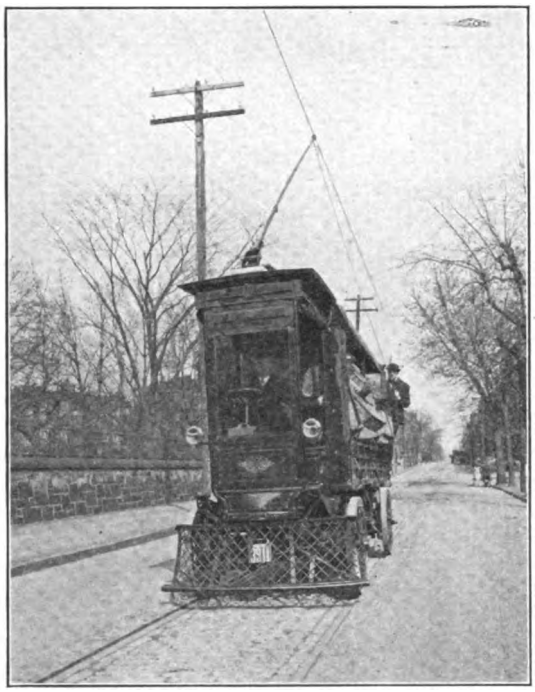

Five-ton Trolley Wagon Operating on Track at Speed of Twenty Miles per Hour.

stated in previous issues of this paper, is equipped with four wheel drive, power being distributed from the battery to four motors attached to the hubs of the wheels, and from the trolley wires to the same hub motors. The motors are wound for 110 volts; the batteries consist of 42 cells. When taking current from the batteries the motors are grouped in parallel; when taking current from overhead wires they are grouped in series. The change from trolley to batteries is automatic, a magnetic switch opening the battery circuit and closing the trolley circuit as soon as the trolley pole and ground wheels are in position. It is impossible to get current from both sources at the same time.

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Twelve gas-driven passenger rail cars are now operating in the grounds of the international exhibition in London. They were designed by a company which has acquired considerable reputation from the efficiency of its motor bus product. The speed of these machines is limited to eight miles per hour. The under frame is of 6 by 3 inch channel steel, supported at one end by a center pivot bogie. The driving wheels are of 22-inch diameter, and the bogie wheels of 20-inch diameter. Engine, transmission, radiator and other units of construction are disposed in a manner similar to that which characterizes the chassis of motor road vehicles. The engine develops 32 hp. It is of the four cylinder vertical type. The vehicles are provided with two forward speeds and a reverse. They are driven only from one end. There is no differential. The drive is transmitted from the change speed gear box to the driving axle by chain. Chain adjustment is effected by sliding the gear box forwards or backwards. The exhaust from the engine is carried to the roof of the vehicle. Each vehicle has capacity for 30 passengers on one deck.

The makers of these vehicles now confidently offer them, equipped for 16 miles an hour speed and with enclosed or open bodies, for use in territory where the heavy expense of overhead construction and fixed power generating plant do not admit of electrification; where horse cars are still employed; where service is not sufficiently frequent to admit of electrification proving economical; where steam cars are in use for want of a better and more modern system; where motor traction is indispensable, and where no roads exist to admit of its employment: where economy is indispensable; where a low capital outlay is an important factor in laying down new rail; and where, along the lines of existing railways, the population is insufficient to warrant the running of frequent train service.

RAPID COMPANY INCREASES CAPITAL.

AT A recent meeting of the stockholders of the Rapid Motor Vehicle Company it was decided to increase the capital stock from $250,000 to $500,000. William C. Durant, chairman of the executive committee of the General Motors Company, took $200,000 of the new issue.

H. G. Hamilton, treasurer and general manager of the Rapid company, states that no merger with the General Motors Company is contemplated, and that Mr. Durant bought the stock in his private capacity. Mr. Durant has not yet been given any office or position on the directorate. Over four-fifths of the stockholders were present, and the vote for the increase of stock issue was made unanimously.

At least $150,000 will be spent in factory improvement. The new building, measuring 60 by 640 feet, which was originally intended to be two stories high, will be of three story construction.

GRABOWSKY COMPANY INCREASES CAPITAL.

NO STOCK now remains in the treasury of the Grabowsky Power Wagon Company, the full $300,000 issue being in the hands of investors. Detroit capitalists recently acquired all that was not issued when the company was formed.

The proceeds of the sale of treasury stock will be used in constructing an additional factory building and in increasing the output of the present factory. There is a probability that the capital stock will be increased to $1,000,000, as at no time since the company has been operating has it been able to turn out product to keep pace with the demand.

The Albany-Berne (N. Y.) Auto Line has been chartered with capital stock of $20,000 to operate motor buses and trucks between the points indicated.

The Barber Auto-Cab and Repair Company, of Brooklyn, N. Y., has been chartered with capital of $15,000.

The Berks Auto Traffic Company has been organized to furnish motor bus service between Reading and Bernville, Pa.

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The London Gasoline Bus

Outline of conditions which are necessary to make big public service machines pay.

By W. WORTHY BEAUMONT.

THE motor bus problem, both now and in the future, is a road problem. Inasmuch, however, as we cannot wait for such road improvements as are inevitable, even if only to the advantage of horse traffic, it is obvious that the development of the motor omnibus has to be considered with reference to the conditions imposed with the roads as they are at present, and as they will be in the very near future. This being so, it may be asked, what is wrong, then, with the better types of motor omnibuses of today? To this question I would reply that the first and most pressing improvements are those which relate to the practices of usage of the machines. Firstly, more attention must be given to the requirements of the motor omnibus as an intricate machine. Secondly, more attention must be given to the requirements of the motor omnibus engineers, who have the responsibility of maintaining the vehicles in a fit condition to be kept on the road. Thirdly, the maintenance, being placed under the superintendence and guidance of trustworthy and competent engineers, they must be allowed to be the best judges of the requirements of their department. Fourthly, the judgment of the engineer, who is responsible for the maintenance of the bus in running order, must be final as to that condition, and not the traffic manager. Fifthly, the running of a number of motor buses means the maintenance of a lot of machinery.

* * *

The Necessary Tool and Shop Equipment.

The last-named requirement, according to the number of motor omnibuses, means an engineering works with good equipment of tools of various kinds, and more or less in number, and workshops of proper construction, and of character suitable to the kind of work which has to be done in them; there should be workshops and appliances which must not be inferior to those of engineering works wherein are made gas engines, and the highest class of millwright machinery. The shops and appliances must be such as will enable men occupied upon the delicate and highly-accurate workmanship to do their work conscientiously and, at least, not in discomfort. In these shops there must always be properly and systematically kept stores, and in the larger shops, necessary where a large number of omnibuses are maintained, there should be under the engineer a foreman who fully understands the construction and fitting of engines, or of a similar high-class, minutely-accurate fitting, and a foreman for all the transmission gearing work and operations. This may seem to be a call for a very large expenditure, but, considered with reference to a number of omnibuses, and with the imperative necessity for thoroughly good and comprehensive maintenance work, that expenditure is not only necessary, but is the means of *making*, because of saving, money. To inaugurate the ownership of motor buses for public service under conditions which I have had to condemn in several cases, namely, by buying a few and commencing to run them with either no provision for maintenance, and no workshops, or only a shed or two and a few tools that might be useful to a country blacksmith, with no stores, no stocks of material and components, unless fuel, oil and grease be considered part of stock, is to court failure, and, generally, the courting has been successful.

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The Penalty of High Speed.

With regard to lines of development, it is well to learn to walk before trying to run. The present motor omnibus of the better kinds is a satisfactory vehicle, if those who use it could be persuaded that it is better suited for a moderate speed than for racing. The motor omnibus which, with its load, weighs 6¼ tons, running, as it often does, at 14 to 18 miles per hour, especially when running home at one o'clock at night on some of the lines, reminds one of an elephant bought for the purpose of running in competition with an Arab steed. One of the first necessities in development is not change in construction, except in so far as gear ratios are concerned, but in the use of the present vehicle with regard to the speed at which it is forced to run. The mere fact that the elephantine omnibus can be run at these speeds is no more reason for running it at them than there would be for loading a girder so that the stress in the materials was, say, 30 tons to the square inch because it was known that the ultimate tensile strength of material was 31 tons.

It would be good policy to arrange the engine and gear of a motor omnibus so that the driver could not under any circumstances exceed, approximately, 12 miles per hour, the gearing being also so arranged that he could, under the conditions of traffic running, maintain a high average speed, so that little time would be lost on such hills as are met with, the power already common on these vehicles being sufficient for the purpose without going to the high powers which have been fitted to some. The engines would, of course, have to be fitted with governors that are governors, and with wearing surfaces of fork, collar, and pins designed with a view to durability. It may be said that a maximum speed of about 12 miles per hour is insufficient; but the statement could only be supported at the present time because so many of the buses are running at high speeds which are unnecessary, uneconomical, and suicidal. I have often urged the objection to high speeds; but I feel it necessary to do so again, because not only are they bad for the reasons given, but they are the cause of a large part of the noise made, even by the best of the omnibuses running, when they are on roads of average condition. It is true that the very high speeds please some people, even on bad roads; but that which is commercially possible must be considered by the owners of things purchased for industrial purposes. It will be much better to work motor omnibuses so as to enable them to be kept on the streets

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than to run the risk of commercial failure and of opposition by the many to whom they are, as at present run, a positive and real nuisance. For example, in certain streets and roads where the surface is bad, objectionable vibration is set up by the high-speed running of a vehicle weighing from 4 to 6 tons with its load, even although that vehicle runs on rubber tires. These same tires, however, are sometimes thin and hard enough to afford comparatively little cushion between wheel and road.

* * *

The Evils of Forced Working.

Another important question in this connection is the distance run per day with the present omnibuses on the roads as at present maintained. The high speed, of which I have complained, is not only the cause of the troubles already referred to, but it enables the omnibuses to be run 120 miles and more per day in the 16 or 17 hours which is its day's work. There are thus only left the few hours from 12 or 1 o'clock at night to the very early hour in the morning at which the bus must leave the yard. In these few and unsatisfactory hours of the 24 a four-cylinder gas engine, with its gas producer or equivalent, its water cooler and air draught, water pump, water-circulating system, its magneto and electric-ignition apparatus, its lubricating system, and all its fixings, a driving clutch and its connections, a transmission shaft and its bearings, a change-speed gear box with all its gear-box bearings, lubricators, fixings, change-speed lever connections, propeller shaft, and universal joints, and the final driving gear, either by live axle and its differential gear and other parts, or by transverse shafts and spur gearing, or by transverse shafts, differential gear and chains, all the gear and parts of two or three sets of brakes, four wheels and sets of axle-ends, and steering gear, all the underframe and spring suspension gear, all the many hundreds of parts, bolts, nuts, rods, pins, lubricators, and pipes, all these have to be, or should be, carefully looked over by competent men, with assistants, with spanners and other tools in hand, so that not only is that which is obvious attended to, but that the defect or looseness which is not obvious may be discovered. The more completely this is done the fewer will ultimately be the necessary renewals and the less the labor in maintaing a thorough inspection. If the omnibuses ran only 90 to 100 miles per day, or even less on some of the very bad roads, no more time in the garage would be obtainable, but the present heavy cost of repairs and renewals might be lessened materially. Further, it must be urged that a thorough daylight examination and overhaul should be carried out once every week, and every garage should be provided with a satisfactory, simple, body-lifting gear, so that the chassis may, from time to time, be made ready for a complete, unfettered overhaul. At present very few omnibus companies have sufficient stand by vehicles; but ultimately it will be found necessary, considering the large number of hours per day that every bus runs, to have at least a stand-by stud of 10 per cent.

* * *

Variety in Coach Fitting and Size of Buses.

Another direction of development, or of evolution, will, I think it quite probable, be the design and construction and working of omnibuses with considerably less seating capacity, and of considerably less total weight. Single-deck omnibuses, and for service even in this country through a considerable part of the year, chars-à-bancs, or other numerously-seated, open vehicles, might be used, as they are in so many places on the Continent, especially if the form there common, in which footboards run along each side, for use by passengers and conductor, are employed. It is generally argued against vehicles of this kind that the wages of driver and conductor form too large a part of the whole takings of vehicles of such capacity, but I have yet to learn two things on this subject; one, that 2 cents a mile paid for these wages is greater than 6 cents per mile paid for extra cost of maintenance of heavy vehicles, and, the other, that there is any act making it necessary for the popular motor vehicle to carry passengers absurdly long distances for a penny.

* * *

The Region of Prophecy.

With regard to the development of the chassis and its machinery, the danger of prophecy is great. It is, perhaps, early to expect it, but it does appear to be desirable that the engines should be provided with a cooling system which does not need the aid of a miniature pumping station, or even of a tin, toy fan. It is also conceivable that the engine might be so made, connected, and mounted that in five minutes all necessary disconnections could be effected, and the engine turned aside or lifted out of the chassis for examinations and adjustments as comfortably as the watchmaker has his watch on his table. It is further conceivable that it is not beyond the capability of the designer to carry the engine in the frame, and so to connect the gear box and all the machinery, not only that the inevitable flexure of the frame may occur without twisting crank-chamber brackets off the chamber, or throwing all sorts of ambiguous stresses on the various parts of machinery and bearings, but that flexibility in the frame may be recognized, instead of fought against, by unsuccessful attempts at complete rigidity.

* * *

Motor Bus Spring Suspension.

The whole weight of the London omnibus is invariably supported upon the axles through leaf springs of semi-elliptic form. Connection of the front springs to the frame is usually made at the forward ends by a simple pin attachment, and at the rear ends by shackles or swinging links. The rear springs are, with very few exceptions, connected by shackles or equivalent sliding junction pieces to permit of movement, to the front or back of the axle position, without longitudinal displacement of the axle in relation to the frame. In a few cases a transverse spring has been used at the rear of, and in connection with, the side pair of rear springs, but this arrangement is now infrequently used, and has generally been found to provide too great a range of spring deflection, and has tended to increase the lateral movement by swaying of the omnibus on the springs. It is a three-point method of suspension instead of the commonly employed four-point method with two springs.

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Design of Axles.

The axles used are of varying form, but generally of similar type at the front to permit of the use of pivoted axle-ends. The pivoted form of axle is required as part of the universally-used Ackerman type of steering gear, by means of which a large steering angle or lock is conveniently obtained with the necessary running clearance between the frame and the wheels when the steering is considerable. The steering angle obtained is 30 degrees, and the turning circle of the omnibus is 55 feet; that is to say, the omnibus could, if required, be turned in a road 55 feet wide. To obtain this steering angle, it is usually necessary to reduce the width of the frame at the front.

In most designs of front axle, the ends are forked to receive the pivoted-wheel axles, as in the original Ackerman design, but occasionally the method is reversed, the pivoted-wheel axle being forked and the center fixed part of the axle formed with pivot ends. Either form is satisfactory, provided the combination of dimensions, material, and workmanship is good. Generally, it would appear that the wide fork is to be preferred, because less heavy stresses are felt by the pivot-pin; and when wear has occurred, there is less lateral freedom of the wheel and interference with steering.

The construction of the rear axles is more varied, because of the different forms of transmission gearing employed; but the common forms may be divided broadly into two types:

(1) Those which are load-bearing and driving axles, or live axles.

(2) Those which are fixed and are load-bearing axles only.

The former type, although frequently used with heavy slow-moving motor vehicles, has been seldom employed for motor omnibuses. Used with some forms of transmission gear it is the simplest form of axle, but it has to withstand a complex combination of stresses, and must be of very large size to be safe. It possesses one advantage, namely, that the road wheels may be easily removed, and with the least disturbance of parts or bearings, provided that the interchangeability of wheels and axles has been studied.

With live axles or gear-driven axles there is some difficulty in securing sufficient strength under heavy loads with anything like moderate frictional resistances, especially when the distance between the wheel centre and the point of application of the load, that is, the position of the springs, is considerable. In some cases the interposition of the brake-drums between spring and wheel enlarges this distance, but it is reduced to a minimum in the Milnes-Daimler, in which the brake is applied to a narrow V groove on the wheel rim. In some others the distance between wheel and spring adds a bending moment to the axle, which, with a heavy form of central-gear drive, differential and case, raises the static and inertia stress to a very high one, and calls for great strength and weight, which is carried by the tires and not by the springs.

For a given load on the road wheel, the bearing of a live axle is at a disadvantage as compared with the bearing surface inside the wheel on a fixed axle. In the latter the pressure upon the journal in the wheel is simply that due to the load on the axle or that carried by the wheel. With the live axle the journal pressure is greater than this in proportion to the distance of the bearing in which the live axle revolves from the center of the wheel.

* * *

The Fixed and Load Bearing Axle.

The fixed or load-bearing axles may be sub-divided into two classes:

(1) The solid straight or bent-bar form, independent of or not connected with the driving gear.

(2) The hollow form containing and providing bearing support for the driving shafts.

These two classes of axle are those now most used; in fact, they are almost exclusively used. The simple fixed load-bearing axle is to be preferred, whether of the solid or tubular form, because, apart from the advantage of division of the work of driving and of weight-carrying or resistance of road shocks, no mechanical disadvantage attends their use.

The removal of the road wheels for examination or repair of either the wheels, tires, axles, or driving gear, may take longer than with the simple load-bearing and rotating axle, but it has to be remembered that, with the forms of driving gear which may be employed with the latter type of axle, more time has to be expended in removing part of the driving gear within the axle housings or casing. It may also be remarked that with the tubular forms of fixed axle, the road wheels may be as easily removed as with the rotating load-bearing axle, and the driving gear is similarly enclosed.

The repairs to road wheels and tires constitute a not inconsiderable proportion of the work of unkeep of the omnibus; and facility of removal and replacement of these parts requires careful consideration. With the designs of axles used, with one exception, with all types of under-carriage, excluding those which are side-chain driven, a considerable part of the weight of the driving gear is added to the axle and is directly supported upon the tires, without relief from the effect of road shocks, such as may be afforded by spring support. By the use of chain driving-gear, the dead weight or weight not spring borne is as far as possible reduced, and to the relief of the driving gear from road shocks has to be added the relief of the wheels and tires.

* * *

Weights Imposed on Axles.

As affecting the question of axle weight, it may be interesting to record that with the Straker-Squire omnibus the weight of the axle complete with wood wheels, springs, and part of the weight of the radius rods and driving chains, is 1,250 pounds. With the gear-driven Milnes-Daimler omnibus the corresponding total weight, including part of that of the reach bars and propeller-shaft, is about 2,500 pounds. With another type of gear-driven omnibus, the Dennis, the total weight, including part of the weight of the radius bars and propeller-shaft, is 1,600 pounds. These figures suffice to show that there may be considerable difference of dead weight upon the wheels and tires.

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Wheel Types Used.

Stoutly constructed wooden wheels of the artillery pattern are mostly largely used. Wheels made of cast-steel in one piece are now principally used with the Milnes-Daimler omnibus, and composite wood and steel wheels with the Leyland vehicles. The composite wheels have hollow-spoked, cast-steel centers and wooden felloes. Although at present infrequently used, their form and appearance are good. The wooden wheels, when thoroughly well made of the best material, last well, and they have been, until recently at all events, lighter than the solid metal and composite. The production of the one-piece cast-steel wheels referred to is confined to very few makers.

The rubber tires are now almost uniform in section, and double or twin tires are used on the rear wheels. From time to time attempts have been made to substitute wood and other materials for rubber, but so far without success. Failure has also attended many attempts to use spring-backed or cushioned wooden-block tires, and the use of spring wheels has not passed the experimental stage.

* * *

Types of Engines Used.

The gasoline engines now used are all of the four-cylinder vertical type. It must, however, be remembered that a number of omnibuses with horizontal engines, some of them in London, have been in use a considerable time with very satisfactory records. The vertical engine may be more conveniently placed in the frame of the under-carriage than the horizontal type, and it permits the most convenient arrangement of the other machinery parts. The longitudinal position of the engine-shaft involves an undesirable right-angle change of direction of drive with present designs of omnibus, but with most of them little trouble can be attributed to this cause. So far as the general design of the modern engines is concerned, fitness for their purpose very largely depends upon quality of material and soundness of work, and upon the readiness with which the active working and wearing parts can be removed and replaced. It is further necessary that the engines should be very substantially constructed or stiffly built to withstand the repeated fluctuations of speed and load. Bearings and all rubbing or working surfaces must be everywhere of more ample dimensions than those commonly employed for motor car engines, and the crankshaft and connecting rods require to be of very strong form, though the weight must be kept down to the minimum. Difference of general design of the engines is now principally confined to the grouping of the cylinders and to the difference of form of the crankshaft and the crank chamber which the use of cylinders, cast in pairs or separately cast, calls for.

The system of valve operation also considerably influences general design. Experience again shows that the successful running of the engines is largely determined by the type and arrangement of the important auxiliary parts used in connection with the carburetter and fuel supply, and with the water-cooling, lubrication, and ignition systems. It is in the design and arrangement of these parts that the greatest difference of practice is to be observed.

* * *

Friction Clutches Most Popular.

With four of the representative types of under-carriage leather-faced cone friction-clutches are used, and they continue to be the type most largely employed for transmission of the power from the engine to the driving gear. Clutches constructed entirely of metal and running in oil have been used with very few types of omnibus. Multiple-disc clutches have been used. They are all made on the principle of the Weston clutch, in which the pressure on one pair of surfaces is brought to bear on any number of such pairs, thus making a given pressure effective over any multiple of pairs of surfaces. Some of these clutches have been used with grooves on the one face and ridges on the other fitting in the grooves, but nearly all are now being made with flat steel annular discs.

* * *

Change Speed Gear and Transmission.

The forms of change-speed gear employed are all similar in that the engagement of pairs of toothed wheels is effected by axial sliding or by side-meshing them. Except for this general similarity they differ in innumerable details as to arrangement, number of wheels, type of bearings, operating gear, form of box, and materials of construction.

Many methods of transmission of power from the change speed gear to the driving road wheels are in use, requiring the use of different types of gearing. Some of these types are completely enclosed and bath lubricated, others are semi-enclosed, and lubrication is not copious, while some are not protected at all, are exposed to weather and road dirt, and only receive intermittent lubrication. The satisfactory performance of all the forms of gearing used depends very much upon the attention given to protection from dirt, and to the thorough lubrication of all active parts. Although quietness of running and smooth working largely depend upon careful construction and workmanship, yet the freedom from noise so conferred will be of short duration if insufficient consideration is given to the lubrication and protection of all working parts Rapid wear of active parts has, however, occurred even when these matters have had the necessary attention given to them, but the causes of such wear and breakage have been mentioned in the early part of this paper. Reviewing the forms of final transmission gearing now employed, it may be remarked that the greater number of types of omnibus are provided with side chain driving gear, as compared with the many forms of gear driving, but that considered numerically the greater number of omnibuses in use are provided with gear drives of several types.

* * *

Brake Construction.

Brakes for any motor vehicles—and, it may be said, especially for motor omnibuses—are among the most important of the details. In almost all the omnibuses at present running, the brakes chiefly used are those operated by the pedal under the driver's foot, acting on bands or brake shoes of one type or another, on brake drums attached to one of the gear box shafts, or to the transverse shafts of both gear and chain-driven omnibuses. In some vehicles the anchorage of the brake bands or shoes is carried by a member of the frame. By this means the stresses due to the resistance to rotation of the brake

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bands are carried by the frame, and the gear box thereby relieved. These brakes, although on drums of small diameter, are powerful, because they are applied to a high-speed shaft, and in many cases are now cast with an internal channel to receive water to keep them cool. Supplementary to these brakes are those on the driving wheels, and they are of several forms. In most cases they are band brakes on drums affixed to the wheels, and in some they are internal expanding brakes inside these drums.

* * *

Early Standardization Not Expected.

No standardization in motor omnibus construction can be expected for some time. The extraordinary mileage accumulated more working experience in a short time than has probably been crowded into the life of any other type of road vehicle. The companies started running them, and the public immediately adopted them, and the companies were constrained to keep them on the road in spite of the very great difficulties which accompanied continuous work and continuous necessity for improvements and renewals. The experience has been very costly, and on the whole it must be admitted it has proved that even with the finest material ever placed in the hands of the mechanical engineer, larger dimensions and greater surfaces are required to contend with the severe work of the present double-decked omnibus. Some further improvements, which will secure durability of parts and fewer breakages resulting from loosening of parts, will no doubt be made; but endurance of known materials used under present conditions of working and road surface cannot be indefinitely extended. Improvement may be looked for in the conduct of traffic that will permit, say, twenty-six-pasenger omnibuses to be run commercially. Then the weight of a bus may be materially reduced, and fuel and oil consumption and wear and tear reduced, and these, with a general observance of the legal speed limit, will add to the life of an omnibus, to its trustworthiness, and to its commercial efficiency. There are now fewer directions in which imagination can point new paths of improvement, but there are still sufficient to make it unwise to act as though a standard of design and construction had been approached.

The Indianapolis postoffice has received notice from the department at Washington that it will be allowed an additional automobile for city delivery. The machine will be of the same style as the two now in service and will be used for collections in the outskirts of the city.

The Pittsburg Taxicab Company has increased its capital from $100,000 to $300,000 and will use the new securities to add 40 more machines to its present equipment of 25.

The Harrisburg, Pa., motor police ambulance will be large enough to convey four patients at a time, high enough within for an ordinary man to stand erect, will have a floor of double oak separated by asbestos, and will be lighted by electricity. When used as a patrol there will be room for eleven policemen.

ELECTRIC RAILWAY BAGGAGE TRUCKS.

PEOPLE who read of or witnessed the installation of electric baggage trucks at the Philadelphia station of the Pennsylvania railroad a few years ago have possibly wondered why such useful machines have not come into more general use in the time that has intervened. Certain minor improvements in design were necessary, and these are now incorporated in a new model of which a large lot is in process of construction for delivery in Philadelphia, Pittsburg, New York and the other important stations of the system.

In the early design of this machine the tongue handle contained the electrical control, the operator walking in front of the truck which was guided by the tongue. In the newer form the operator is mounted on a small platform and steering is accomplished by means of a wheel at a fairly rapid rate of speed under load. The order for the construction of these trucks was officially placed a month ago and deliveries have already been commenced.

THE NECESSITY OF ACCIDENT INSURANCE.

THE service of all commercial motor vehicles should be covered by insurance which gives owners immunity from loss sustained through the carelessness or recklessness of their drivers, as well as the unavoidable accidents of the road. The frequency with which damage suits are brought by the victims of motor wagon, bus or cab accidents should be an impelling cause for carrying insurance of the kind described. Street traffic may be ever so well regulated, and yet it is impossible to prevent collisions and disasters having very grave consequences. The tendency of motor drivers to take advantage of every opening in traffic, in order to make the speed of their machines count, is a practice which is sure to lead to trouble.

The owners of machines which ply in the congested downtown districts of large cities are peculiarly liable to damage suits. The risk from accident to cab operators is so well known that insurance covering it is a fixed part of the administrative expense. With the present tendency to mulct the owners of motor vehicles of all sorts in suits brought for damages for injury, it is good policy to be on the safe side. Nowadays the victim of a motor road vehicle accident who has sustained no greater injury than the breaking of an arm sues in court for $20,000 and is often awarded a fourth part of that sum. It is quite plain, therefore, that owners of commercial motor vehicles of all sorts should carry accident liability insurance and charge it to the general administrative expense account.

Motor bus service has been commenced in Bloomington, Ill.

Steam motor bus service is being provided in Middletown, Ohio.

The project to establish motor bus service between Monroe and Cincinnati has been abandoned for the present. It will be taken up again next year.

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Motor Cab Service Badly Regulated

Review of conditions which exist in New York City and work injustice to operating companies.

MUCH yet remains to be accomplished before motor cab service in New York can be considered either well or justly policed. The passage of an ordinance which regulates charges does not necessarily denote that its terms are equitable alike to those who obtain service and those who provide it. Indeed, there is good reason for believing that rates and operating privileges do not square very well. The opportunity for seeking traffic wherever it may be procured is denied. Machines by custom are parked outside of hotels, clubs, railroads, restaurants, or other places of general assembly. Few are found on public rank. Cruising and the picking up of a fare on return trips is prohibited. Motor cab proprietors are not unwilling to submit their business to wise municipal control, but they protest that it is unfair to place restrictions upon the operation of their machines which are given special classification, while treating them as if they were employed in public service.

* * *

Private Stands and General Solicitation.

To further complicate matters the proprietors of horse-drawn cabs assert that the machines have no right to occupy private stands and solicit general trade. They, in their turn, protest that the city ordinance gives taxicabs the right to stand at such places if they get permission from the bureau of licenses. Such licenses can be issued only if the owner or lessee of the property gives his written consent. A condition attached to the permit is that the machines shall carry as passengers only the guests of the establishment outside of which they stand. It is this part of the ordinance that is being violated. The hack drivers complain that all the best corners which were formerly public hack stands have been usurped by private motor cab operators who are paying a rental for them to the owners of the adjoining property, and who, to make a profit, are compelled to charge exorbitant rates. This issue between the hackmen and machine owners is now being tried in court.

* * *

Majority of Machines Not Public Vehicles.

Only 10 per cent of the motor cabs in New York are public vehicles in the strict sense of that term. The remainder are special vehicles. In effect, therefore, the city is compelling the owners of private vehicles to submit their business to public regulation. As the ordinance does not become effective until September 29, the motor cab proprietors hope to obtain a new classification for their machines which will enable them to appear on the streets under the same conditions which govern the traffice of ordinary cabs.

With the conditions as they are it is said that service is provided at a loss. The voluntary reduction from 50 cents for the first half mile, the present rate, to 30 cents, recently made by the New York Taxicab Company, and treated at length in another part of this paper, does not create much sympathy for this opinion. It is asserted that every motor cab is compelled to run at least sixty miles a day to collect $15, the fare for thirty miles, because it is always compelled to travel empty in returning to the garage or special stand. The companies will test the ordinance in the courts, on the ground that the city cannot regulate rates and at the same time limit the amount of business done.

* * *

Forty Cent Rate is Not Profitable.

The attorney for the motor cab companies says:

"I have pointed out, in my argument before the aldermen, that it would be impossible to carry on under the present ordinance an efficient service at a lower rate than 50 cents for the first half mile, and 10 cents for each subsequent quarter-mile. The calculation on that point is clear and convincing."

"Would not 40 cents for the initial half-mile yield a fair return, even with the wear and tear taken into consideration?" was asked.

"It would not," he answered. "I can say that positively, and my assertion is borne out by the figures of the companies, compiled separately and without any understanding or collusion. They do not vary more than the fraction of a cent a mile. The smaller the company and the fewer the vehicles in its service, the greater the loss; but even if there were a consolidation of all the competing interests, and expenses were pared down to the lowest possible point, no profit could be expected at a lower rate than 50 cents for the initial half-mile. Even then the return is bound to be smaller than in other systems of transportation.

"Permission to solicit business on the street, after service has been performed, and the vehicle is at liberty, is essential if the service is to be continued. What would you say if a street car carried passengers from the Battery to the Bronx, and went back empty to the Battery? The principle is precisely the same."

* * *

How Rates May be Lowered.

Some believe that by granting full privileges to all motor cabs the lowering of service rates would be automatically accomplished. This opinion is ably defended by Richard W. Meade, president of the New York Transportation Company, who says:

"We have made the experiment of charging 10 cents less than the rate made by this ordinance. Our cut was the result of competition. We came down to an initial charge of 30 cents, as against 40 cents provided by the new measure. Another company which had cut its rates finally went back to 50 cents for the initial charge, and we did the same thing, as that is the present legal rate.

* * *

Five-Sixths of Trade Done by Special Cabs.

"We had had plenty of experience in the local field, and we were in a position to know just what the service cost here. Persons who had studied the situation in London, Paris and Berlin were able to evolve theoretical

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profits, but not to earn actual ones. In those three great centers of European population the taxicabs take their fares to any point as directed with a probability of being able to make money through their return. In New York the greater part of the taxicab business is done from private stands and the chauffeurs are permitted by law only to obtain fares at the points designated. There are here two classes of cabs, the public cab, which has no regular stand and which may do business anywhere, and the specail cab stationed at specific hotels and restaurants. Approximately five-sixths of the total business goes to the special cabs.

"When a hotel man enters into a contract to have cabs stand about his premises he naturally tries to get a reputable concern to agree to furnish the finest cabs that can be obtained. It is an advantage to him to know that the contracting person is liable for any damages and will furnish attractive vehicles. The special cabs that control the lion's share of the business cost on an average more than the public cabs. They are better equipped, cleaner, and the chauffeurs should be kept under good discipline. The cabs are necessarily kept a considerable part of the time in idleness, and those who hire them must pay in the long run for the time lost. Then if the patron wishes to go to the Grand Central station or to the Pennsylvania railroad the cab must return to its stand empty.

"Just think what sort of rates the transatlantic steamships would have to charge if they had to make the trip between New York and Liverpool empty one way!

* * *

Hardships of Special Cab Proprietors.

"The special cabs presumably take fares only from the starting point specified in their licenses. In other words, if a man takes a taxi from the Waldorf-Astoria to the City Hall the chauffeur must make the return trip of four miles with empty seats, and the passenger who has been taken down town has had to pay not only for his own trip but for the return in which no other passenger can be obtained.

"The legal rates are the same for the public and the special cabs. The special cabs pay $25 to the city for their permits to remain at the stand. The public cab does not have this item of expense.

"The new ordinance provides a $10 license for each cab provided with a taximeter. We think that amount is unnecessarily high, as it should not cost the municipal authorities any such amount to keep the meters in order. However, we wish to have public confidence restored by having the taximeters properly examined, as we feel that certain crooked concerns have used the taximeter as a lure to the public and that reputable companies have suffered as a result. We have done everything required by law in London, Paris or Berlin, but we are convinced that certain other concerns have derived profit from the lack of restraint and that a part of the public does not differentiate between the companies.

* * *

No Monopoly of Service.

"There is no monopoly in taxicabs in New York. I believe that about twenty-five corporations, firms and individuals were represented before the board of aldermen by one counsel. While some of the smaller concerns have good cabs and make every effort to give satisfaction, it seems to me that it would be very difficult for them to provide as good service as the larger companies. To begin with ,there is a question of responsibility. The small operator should have a liability insurance or else he cannot protect the public. He is apt to find that the rate of insurance demanded is prohibitive. The New York Transportation Company does business on such a scale that it requires no such insurance. We settle claims as policy and justice require from time to time. It has not been unusual for us to have to pay $400 or $500 for baggage left in a cab, where negligence was established on the part of our drivers. If they had used certain other vehicles those who have received these sums would have had to whistle for their money.

"The average New Yorker believes that there is an advantage in taking these special cabs and the city will never get cheap fares until the chauffeurs are permitted to pick up any business they can get on their way back.

"I do not think that most of the patrons of taxicabs will care very much about the total reduction they will obtain under the new ordinance of 10 cents on each trip, although the companies operating the cabs will lose money unless they can find a way of cutting expenses. The other feature, involving the regulation of taximeters, meets with our approval, as we believe it to be a good thing. We do not think that the 10 cents reduction will do the public much good, but we know that it may do the companies a lot of harm. Taxicabs have been in operation

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Depreciation Losses Are Enormous.

"As pioneers we have discovered that the losses through the depreciation of stock are enormous. Some of the concerns which have gone into the taxicab business more recently have only just discovered the extent of the depreciation. One company now going through bankruptcy proceedings offered in its prospectus 115 per cent profit.

"A motor car costs from $2,000 to $3,000, and our experience is that this cost must be written off in about three years. That means that $1,000 a year, or between $2 and $3 a day, should be written off on each of the cabs. A motor may last more than three years, but our experience is that at the end of that period something much better must be substituted in order to get business in competition. The industry is making such advances that we think that those who wish to make certain not to fool themselves should write off the entire value of the cars in three years, providing for obsolescence instead of mere depreciation. Several new companies have prepared to charge off their cabs, on a six year basis, but we think they will wake up in half that time and find they have made a mistake."

The Waddell and Emerson Stage Company, of North Creek, N. Y., has been incorporated with capital of $12,000 to operate motor buses between Riverside Station and Schroon Lake.

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Police Department Machines

Comparison of motor and horse drawn vehicle performance which establishes the superiority of the former.

ALTHOUGH the employment of motor vehicles in police service was early indicated, their use is still somewhat grudgingly tolerated by municipal officials whose minds are poisoned either by what they have read of heard of the extravagance alleged to be incident to the maintenance of such machines. That they are more efficient than horse drawn police vehicles cannot be denied. Touching their economy, only the testimony of the police departments which have used them can be regarded as conclusive. If, however, one considers economy as inseparable from service rendered—and this is the true method—then only one opinion will prevail, for the work capacity of any motor police vehicle, whether patrol, ambulance or detective squad machine, is beyond all question far greater than any other transportation convenience it is possible to provide. The high daily mileage, great range, and superior speed of such machines break down all argument to the contrary.

It is not the fault of police chiefs that their departments are not freely supplied with all the machines which a wise administration of the service would seem to require. The stupid outcry against the alleged extravagance occasioned by the maintenance of municipal machines of all kinds has spread its contagion so far that fat witted aldermen all over the country deem it due their constituents to block appropriations for the betterment of the service. They prate about "joy riding" and high upkeep, but rarely commend the important work which motors are capable of rendering. None but the police authorities know what surprising feats are performed by the use of automobiles, or what property losses, crimes and peace disturbances are prevented by their timely employment. To deny the utilization of such means for the preservation of good order is in itself an offense, as we shall presently observe.

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Not long ago 150 police chiefs were assembled in convention at Buffalo. The gathering was international in character. Naturally public service methods were discussed from every point of view, analysis of the utility of the police automobile giving the greatest concern to all present. The chief of the Louisville department expressed much of the sentiment general among the police officials throughout the country in speaking as follows:

"From the standpoint of economy the automobile has an advantage over the horse-drawn vehicle. Our patrol wagons, equipped with horses, harness, etc., cost in the neighborhood of $1,800 each. Our automobiles cost in the neighborhood of $1,900 each. The average life of the automobile, when properly cared for, is just as long as that of the ordinary patrol wagon; but the automobile has the advantage in that when it has outlived its usefulness in the police department it may be disposed of for a considerable sum, while the worn-out patrol wagon is of practically no value.

"Again, the automobile is less expensive to operate than the two-horse patrol wagon. I find that our automobiles cost us on an average of $18 per month to operate. This expense is apportioned about as follows: Gasoline, $5; oil, etc., $2; repairs and incidental expenses, $11. Our figures show that on city work it costs us a cent and a half per mile to operate our machines. In the operation of the two-horse patrol wagon, as we all know, it is necessary to have one and sometimes two extra horses, to be pressed into service to relieve the regular horses when they become worn out from overwork or disabled from any cause; and during busy periods it is necessary to have two shifts of horses, each working twelve hours. Thus we have at least three horses to a wagon. When you figure oats at 56 cents per bushel, pay your shoeing and veterinary bills, you will find that three horses cost you in the neighborhood of $50 per month, a saving of $32 in favor of the automobile. Hence we find that even from the standpoint of economy the automobile has the call. But when we consider the many advantages of the motor vehicle over the horse-drawn vehicle, I think we will all agree that this is a case where the question of cost should not be considered, even if we have to exceed the appropriation.

* * *

"Some may think that I have not made a sufficient allowance for repairs per month. My experience has been that the cost of operation and repairs depends largely on the men handling the machine. It has been my aim to reduce this part of the expense to the minimum. We have a man, whom I secured from a garage, who is a practical mechanic, now with rank of sergeant in this department, whose business it is to keep the machines in proper repair and who does the principal part of the work on them.

"Some business men and private owners of automobiles may take issue with me on the figures of cost of maintenance, but it should be borne in mind that our figures are based on the actual use of the machine for patrol service, and, as stated before, having our own repair man, the figures given represent the actual cost of supplies, gasoline, etc., for patrol service, based on number of runs made. Some days the automobile will make fifteen or twenty runs, while the next day, it may not be so actively employed.

* * *

"Formerly, a police department's whole work almost entirely consisted of the running down of criminals. While that is very conspicuously its work still, there is a much broader field of labor assigned to it, and it has manifold duties in connection with the various branches of the city government.

"When I took charge of the police department for the second time, in July, 1907, after an absence of six years, my attention was very forcibly drawn to the woeful lack of facilities in the police patrol system. The city

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had grown considerably during that time, and the department was still using two-horse patrol wagons. It was a common occurrence for the wagons to make round trips of five or six miles for a prisoner, which, in addition to the wear and tear on the horses and equipment, consumed from an hour to an hour and a half. This consequently left a district without a patrol service during that time, and on occasions, when important calls came in, there was nothing to do but to await the return of the wagon, or walk to the scene of action, when a street car was not available.

"Naturally I began to look around with a view to improving the service in this respect, and it was then that my attention was drawn to the automobile as a police department adjunct. The advantage of a modern and up-to-date motor service was readily foreseen, and I did not meet with much difficulty in getting the police department supplied with a five-seated automobile, the trial use of which was so obviously an improvement that two more five-seated machines were ordered shortly afterward. We now have under consideration the purchase of additional machines that will seat seven persons.

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"It was only after experience and very careful investigation that I decided there should be nothing about our machines to identify them from any other automobile. As evidence of the fact that the automobile is of invaluable service to a city in times of trouble, I may mention our experience in the month of March, 1907, when Louisville was in a state of riot brought on by a street car strike. The police department at this time did not own or use automobiles and was considerably handicapped in handling the strike for the lack of proper facilities for getting to scenes of disorder and riot promptly, with the result that we were utterly unable to cope with the situation. In November of the same year another strike was declared, and, profiting from observation of the manner in which the previous strike had been handled, I immediately hired fourteen ordinary automobiles, each of which was manned by six plain-clothes men, with the result that they were able to slip up on the law-breakers unnoticed. The rioters were soon led to believe that every automobile which came into sight was loaded with detectives, with the result that demoralization soon spread into their ranks.

* * *

"The prime advantage of the automobile over the horse-drawn vehicle is its economy. Consider a suburban machine run twelve miles from the city as compared with the time consumed by a horse-drawn vehicle over the same distance, and you will find a difference of several hours. Can you tell where time is more truly money than in this great department of public service? I think each of us can readily recall numerous instances where if we had been just a few minutes earlier in getting to the scene of trouble we might have saved, later on, endless hours of work in our efforts to locate and apprehend fugitives.

"With the now common use of telephones there are many instances where police stations are called up at all hours of the night by female members of households, who may hear noises or see suspicious persons lurking about their places. Since almost every home is now provided with a telephone, the quick response of the automobile has resulted in much good and general satisfaction to our people. On several occasions we were able to reach residences and surround them before burglars came out with their loot, whereas, if response had been made to these calls in the old-fashioned way, I am quite sure the birds would have flown long before the wagon reached the scene.

"The quick response of the automobile is likewise a most welcome sight to a patrolman on many an occasion when he has one or more unruly persons in custody. Frequently, during busy times, especially on Saturday night, when the horse-drawn vehicle was used, officers were compelled to stand with prisoners until the wagon had made runs in other parts of the district. This naturally caused a crowd to congregate, and, with the customary jeers and taunts from the small boy and the friends of the prisoner, the officer's position, especially in negro districts, becomes a defenseless if not a dangerous one. During these periods of delay a peaceable thoroughfare can be transformed into a scene of rowdyism and disorder.

* * *

"Our experience has been that we can make four long runs with the automobile in the time that it formerly took us to answer one long run with the horse-drawn vehicle. Think of this from a humane standpoint, especially in hot weather. I have in mind one case where a run was made to a point about three and one-half miles from headquarters, over fair roads, in nine minutees. The prisoner was placed in the machine and returned to headquarters in twenty minutes from the time the call was received.

"I recall several cases where we used a machine to great advantage. Only recently we had a case where a party attempted to leave this world via the poison route. Within ten minutes from the time we received the call we had the patient at the city hospital, where, by prompt medical attention, his life was saved.

* * *

"During the last street car strike I was called over the phone by a citizen who informed me that a large crowd of rioters were passing through the alley in the rear of his home, armed with missiles, and from their actions he inferred that they intended to attack a street car two blocks away. We instantly manned a machine with six officers and reached the point of attack, a mile from headquarters, in three minutes, just as the band of strikers were coming out of the alley, however not before the approaching car, containing women and children, received a fusilade of pistol shots, boulders, etc. Our sudden and quiet descent upon the mob spread consternation into their ranks and they were instantly dispersed, and we succeeded in arresting forty-five of the rioters within three hours."

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GLARING EXAMPLE OF OVERLOADING.

OVERLOADING is an abuse so commonly encountered in motor wagon service that constructors deem it prudent to anticipate the danger arising therefrom. But without sacrificing the essential qualities of good design it would be utterly impossible to build a machine which will successfully withstand the rough and unintelligent treatment to which some owners are in the habit of subjecting their transportation equipment. Costly experience alone will teach such people that the rated capacity of a vehicle cannot with safety be greatly exceeded.

Putting a three-ton load on the platform of a wagon designed to carry 1,000 pounds is an example of folly one would think none would perpetrate. Yet the photograph shown in this page proves that such an opinion is altogether too liberal. The owner of the machine under consideration well deserves the misfortune which his ignorant treatment of it is sure to occasion. And yet, judging from the well observed habit of his kind, it is likely that when the machine fails in service the blame for it will be ascribed to the designer. The overload in question is the most glaring example of ignorant administration of which there is any record.

It is expected that motor buses will be put in service between Green River and Opal and that point and Piney, Wyo.

Motor bus service has been established between Harbor Springs and Forest Beach, Mich.

Light motor truck and bus service is being furnished between Santa Ana and Laguna Beach, Calif.

HAULING CANAL BOATS BY MOTOR.

THERE is every reason to believe that canal freight can be hauled more economically and expeditiously by towing road motors than by mules or horses. If this supposition can be broadly demonstrated it would be safe to say that there would be an active revival in canal transportation, which, since railroading began to assume its present huge proportions, has dwindled into relative insignificance.

The Lehigh Navigation Company is the only concern in this country which is paying intelligent attention to the subject of motor canal hauling, and its experiments have progressed sufficiently to warrant the expectation that the new method of towing will soon be so extensively utilized as to make necessary the expenditure of $1,000,000 in reconstructing the tow path from Philadelphia to Mauch Chunk so as to make it suitable for motor traffic.

This company now declares that mule towage is more costly than motor towage. This opinion was only reached after several unsuccessful efforts to make the tractive power of a motor truck available. In carrying out the early experiments tow ropes broke in starting and driving wheels slipped. Both of these troubles, however, were soon remedied, and early last month motor towing was pronounced an unqualified success. One day 600 tons of cargo was transported by the aid of one motor truck.

Motor buses are operating on the streets of New Haven, Conn.

The Eastern Auto Transit Company has been organized with capital of $35,000 to operate motor buses between Albany and Schenectady, N. Y.

Half-ton Wagon Overloaded to Three Tons.

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NEW YORK'S MOTOR MAIL SERVICE.

MUCH satisfaction is expressed by the higher officials of the New York postoffice over the service of 14 high speed electric wagons used in collecting mail from stations north of Forty-second street on the east and west sides.

Starting July 1, a contract for the operation of an all motor service began within the district just mentioned, which includes 19 subpostoffices, any one of which is large enough and has all the facilities for handling mail for a city of 5,000 inhabitants. Some of these minor stations have half-hourly service, receiving and dispatching all first class matter every 30 minutes from 6 o'clock in the morning to 7 o'clock in the evening. Nearly all of the circuits, some of which are six miles long, must be covered at least 10 times a day, while others are to be traversed 34 times every 24 hours, or 216 times a week. The combined length of all the routes is 199-100 miles and the total number of trips in both directions over these routes each week amounts to 1,052. This involves an annual mileage of almost 200,000 miles, or upwards of 800,000 miles during the life of the contract, which was awarded May 12 last.

This is the most important governmental contract for motor wagon service ever signed, and its successful execution will undoubtedly lead to the establishment of similar service in every important city throughout the country.

Just as soon as existing contracts for horse wagon service in other sections of New York expire the postmaster will advertise for bids for substitute motor wagon service. The horse vehicle contracts expire in other divisions of the city on July 1 successively during the next three years.

By the new method of transportation the department has reduced the running time between the Grand Central postoffice and the Fox street station, in The Bronx, from 119 to 54 minutes. On the west side there has been a reduction of about 25 minutes.

Of the 14 wagons employed, 2 have a carrying capacity of 4,500 pounds, 4 carry 2,500 pounds and 8 transport 1,300 pounds. The motors have not replaced the small postoffice wagons used for the collection of mail from letter boxes, but the trucks which formerly took mail from the Grand Central station northward to branch postoffices.

First class mail matter above Forty-second street, on the east side, has been carried from station to station on the Third avenue elevated, and this method will be continued from 11 p. m. to 4 a. m. On the west side first class matter is conveyed by the pneumatic tube, except during the same hours, and the conditions of the motor service are similar there.

MOTOR WAGON ON GLIDDEN TOUR.

FOLLOWING its custom of years past, the Rapid Motor Vehicle Company dispatched one of its light machines to accompany the Glidden tourists and take care of their surplus baggage. The machine, which is rated to carry a ton, not being sufficiently weighted with baggage, also carried tire air bottles and some junk to bring the load up to rating. During the tour its speed was about 15 miles an hour. Its daily mileage was about the same as that of the pleasure cars, the schedule of which it was expected to maintain.

The gondola traffic of Venice, Italy, is scheduled to suffer from the competition of the motor bus.

Rapid Truck in the Glidden 2,500-mile Tour.

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NEW YORK CAB RATES CUT.

WHAT is to be thought of the sincerity of motor cab operators in New York when one week they stormily declare that they will lose money if they are compelled to accept business at the newly authorized rate of 40 cents for the first half mile and immediately thereafter the strongest of them, the New York Taxicab Company is found voluntarily cutting the present rate of 50 cents for the first half mile to 30 cents?

Only two deductions can be drawn from such a policy. Either a war of extermination is threatened, or else the hardships of the operators have been grossly misrepresented. The situation is too grotesque to admit of any middle opinion.

In appearing before the board of aldermen, the lawyer who represented the twenty odd companies which fought the passage of the recently enacted law, emphatically declared that at 40 cents for the first half mile it would be impossible for his clients to make money. This statement he boldly asserted, was substantiated by examination of the books of the companies for which he was authorized to plead. The echo of his protest, however, had scarcely died away when a reduction of 25 per cent is announced. In addition to the cut already mentioned, the New York Taxicab Company announces a 10 cent charge for each quarter mile after the first one. Nor is this the full measure of its liberality, for these charges are applicable whether the load is one or four passengers, day or night, sending charges being borne by the operators.

The company's explanation of this remarkable change of front is that its private telephone system, connecting its 54 stands, enables it to avoid much of the operating expense which competitors find so oppressive. The advantage claimed for the private telephone system is that it enables machines to render very active service without high dead mileage, the machines are at the end of trips reporting, not to the stands from which they set out, but to the one nearest the point of destination within control of the telephone system.

It was on the suggestion of the New York Taxicab Company in the spring of 1908 that the management of the other companies agreed to raise the initial rate from 30 cents to 50.

One of the company's officers denies the imputation that the reduced tariff will only be temporarily operative. He says: "The suggestion that the New York Taxicab Company is reducing its rates of fare for the purpose of influencing the determination of questions now in court is ridiculous, as is also the suggestion that the reduction is prompted by a desire to inflame public opinion against the hackmen. This reduction of rates has been under consideration for several months. Its announcement has been delayed out of consideration for the wishes of other owners and operators of taxicabs and pending the discussion by the Board of Aldermen of the recently enacted ordinance.

"It has no meaning beyond the desire of the New York Taxicab Company to keep the lead in supplying the public with the highest type of service at the cheapest possible rates. It is dictated by our good faith in the wholly selfish business principle that the more general the use of taxicabs the more the company can do to improve and enlarge the service and keep pace with the great needs of the public for this method of transportation.

"The suggestion is quite absurd that the Board of Aldermen intended by their ordinance to fix cab fares at an arbitrary high plane, and that the New York Taxicab Company must of necessity evade the ordinance in reducing its charges."

QUIET-RUNNING MOTORS.

A PROBLEM on which the engineers of the Association of Licensed Automobile Manufacturers have spent a good deal of study is that of making quiet-running gas engines. Some of the principal causes of timing-gear noises are inaccurate machine work on the crank case, causing too wide variation in the distance between gear centers; unsuitable crank shaft and cam shaft bearings, causing jumping of the shafts when the motor is running; inaccurately spaced and poorly designed gears, causing warping after the strain of cutting the teeth is removed. The utmost care must be taken in fitting cam gears, and sometimes one or two of the gears may be changed to good advantage, even though they are apparently the same size and shape.

The chief cause of noise in timing gears is the uneven or intermittent load due to the lifting action of the cams, causing intermittent pressure on the teeth and even reverse pressures, producing slapping of the gear teeth, due to backlash. There are a number of points to be taken into consideration in ameliorating this condition, such as reducing the weight of the valve mechanism, proper tension of the valve springs, the use of suitable relatively non-resonant material, shaping cams to give soft action to the valve plungers, proper pitch and lubrication of gears, and amount of permissible backlash.

Noise from pistons, connecting rods and crank shafts has been practically eliminated by accurate work and bearings, and proper lubrication and clearance between the pistons and cylinders. All pistons and connecting rods must be of equal weight and as light as possible.

The crank shaft must not be too light; undue side play of connecting rods must be avoided.

The principal cause of valve noise is allowing the valve to slap on its seat. The descent of the valve should be suddenly arrested just before it strikes its seat, either by a slight rise in the cam or by a very gradual taper. The valve spring should be of sufficient strength to keep the roller in contact with the cam. One leading experimenter says that in proper design the sound produced by the seating of the valve cannot be heard outside the motor with the manifold carbureter and muffler connected. The weight of valve necessary to give the best result is a matter for mature consideration. The thickness of wall and shape of the manifold are also important.

Gasoline cabs are not permited to operate in Hamburg, Germany.

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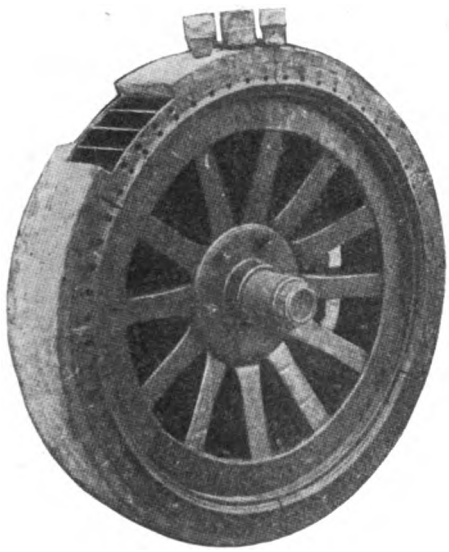
NEW WOOD TREAD FOR HEAVY DUTY WHEELS.

PLENTY of instances occur where wood-faced road wheels could be advantageously employed in hauling large loads. The half-hearted efforts to produce such a tread have caused solid rubber tire manufacturers to accept the responsibility for wheel equipment of machines whose service is unusually hard upon their product.

The cushioning of loads up to, say, 5 tons in city service by means of solid rubber tires is virtually a necessity, and it is quite interesting to observe that the traffic frequently stands the high expense of such equipment. As, however, there are many motor wagon services in which the margin of economy is exceedingly small, operators are confronted with the alternative of using steel tires or a



relatively cheap substitute. The inelastic properties of a steel tire, together with its tendency to skid on greasy and frosty surfaces, are well known. Its inability to cushion the mechanism is its chief shortcoming. All well designed wood wheels, or steel wheels with wood tread, are lighter, more efficient and more economical in service. They have a certain amount of resilience which is decidedly useful in keeping working parts of the chassis in good order.

Up to date no concern in this country has seen fit to design and market either an all-wood wheel or a steel one wood-faced. Various vehicle manufacturers have, in an amateurish way, experimented with such construction, but it is not a matter of record that much time or ability has been given to the subject. Yet the opinion is prevalent, both in engineering circles and among the owners of heavy duty vehicles, that such tires should be produced.

Closer attention has been paid to such construction abroad, especially as equipment for high wheeled tractors, and as a result of these researches a new tread has been devised for low wheeled motor wagons of the ordinary type. The latest design of this character, consisting of sectional blocks of hardwood securely fitted into a specially formed metal ring, is shown in the accompanying illustration. After 1,000 miles of severe road work the tread appeared to be in perfect condition, the wear on the periphery being even. Six castings, each containing 10 pockets, or 60 in all, are fitted to the steel band. The ends of these pockets are inclined and of taper cross-section. A tight fitting section of hardwood, the grain of which is perpendicular to the tread, is driven into each pocket. The depth of the wooden blocks is 3 inches, half of which is imbedded in the pockets. The blocks are 7½ inches long. They are retained in position by means of wooden screws driven through the outer lips of the castings. The removal of these screws permits a change of the wooden blocks as they become damaged or worn. It is interesting to learn that the wooden screws, after prolonged trial, show no tendency to bend, no matter how bad the road surface may be.

INSURANCE COMPANIES INDORSE TIRE CHAINS.

THE use of tire chains for the prevention of side slip is now indorsed by two insurance companies which have been rather hard hit lately by accidents of one kind or another which have arisen from the skidding of commercial and pleasure cars. The following circular has been distributed by the two companies in question to policy holders:

"This corporation does not presume to dictate to a policy holder the precautions which he shall observe for the prevention of accidents. It does, however, expect that he will do his duty to the public at large by using the utmost care, and among other things we urge the advisability of using such safety devices as the ordinarily cautious man would employ, such as adequate brakes, signals and anti-skid chains. Our policy of insurance indemnifies the holder against legal liability, but no policy can indemnify the holder against criminal prosecution, to which, in the present state of public opinion, owners of motor cars are perhaps more exposed than the owners of any other form of property. If the clamor of public opinion did not have its effect upon the decisions of our courts, and exact justice always was done, many suits against owners of self-propelled vehicles would be quashed at the opening of the trial. It, therefore, behooves the owner who would place himself beyond the possibility of these unpleasant experiences to use the utmost degree of care and to employ safety devices whose merits have been proven, in which class we refer particularly to the anti-skid chains which are marketed, and which are intended for use when roads are covered with ice or snow or when they are otherwise in a slippery or dangerous condition."

CLARKSON SUCCEEDS CHALFANT.

THE resignation of E. P. Chalfant as general manager of the Association of Licensed Automobile Manufacturers recently made it necessary for the board of managers to select some one to fill the unexpired term of his office. The choice fell upon Coker F. Clarkson, who is now acting in the capacity of assistant general manager of the association.

The British Indian government has accepted an offer from Europe to place 100 first-class and 50 second-class taxicabs on the streets of Bombay by next October.

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AMERICAN LOCOMOTIVE COMPANY'S TRUCK.

FULLER particulars of the American Locomotive Company's three ton gasoline truck are now available than when the machine was first described in a recent issue of this journal.

An interesting feature of the machine is the method of supporting the motor. It is carried on a sub-frame extending to the extreme forward end of the truck. By removing the front cross member of the main frame and the radiator, and disconnecting the gasoline pipe, control connections, clutch shaft, exhaust connection, and the bolts which secure the motor to the sub-frame, the engine may be drawn out through the forward end of the frame. Two men may remove the motor from the truck inside of a half hour. The motor is accessible from either side through hinged doors, and from the top through the floor boards.

The radiator and gasoline tank are elastically supported on springs, and flexibly connected to the motor. The radiator may be removed by taking off two nuts and withdrawing two bolts. The gasoline tank is protected from the heat of the motor by a sheet iron plate below it, which provides an air space between it and the tank.

The entire truck is of extremely robust construction. The frame, axles, springs, wheels, bearings and tires are made extra heavy to provide for overloads. The radius rods, brakes, all brake connections and all working parts have been made with unusually ample bearing surfaces. Bushings are provided in working joints wherever possible, to facilitate and cheapen cost of replacement. Clevices and pins are unusually large, and hardened to minimize wear. No expense has been spared in the selection of materials best adapted to the service imposed upon them, nor in the accuracy of machining and fitting parts.

The motor is of the 4-cycle 4-cylinder vertical type, cylinders cast in pairs, bore 3 15/16 inch, stroke 4¾ inch, developing 24 hp. at 1,000 r. p. m. The crank case is of aluminum, the crank shaft bearings of Parsons white brass, and the crank shaft of chrome vanadium, or "special alloy" steel. The motor is supported by the upper half of the crank case, which is provided with openings for inspection of bearings, etc. The lower half of the case is easily removable, and is independent of the main bearings. This is a very desirable feature, as it permits adjusting the bearings independently of each other and of the lower half of the case. The valve heads are of high nickel steel, which is not subject to the corrosive effect of hot gases. This insures durability and lessens the danger of leakage due to warping and pitting of seats. Water circulation is effected by gear driven centrifugal pump.

Ignition is by Bosch high tension magneto, with fixed advance. This deprives the careless or unintelligent driver of a means of abusing the motor. The motor is also governor controlled at the maximum speed of 1,000 r. p. m., which further reduces the liability of abuse on the part of the driver.

The clutch is of the multiple disc type; the discs alternating, of steel and bronze, entirely enclosed and running in an oil bath.

The transmission is of the sliding gear selective type, comprising three speeds forward and one reverse. The gears, shafts and bearings are exceptionally large. The gears are of nickel steel, case hardened and drawn to a point where brittleness disappears. Chrome nickel steel is used in the differential. Hess-Bright bearings are used throughout the transmission. A three point suspension is provided for the transmission, to protect it from the twisting of the frame.

The final drive is through chains. Exceptionally large brakes of the expanding type act on the interior of the drums carrying the rear sprockets. One set of brakes is operated by pedal, and the other by a hand lever.

The steering gear is of the worm and sector type, irreversible, of ample proportions throughout, and with large wearing surfaces. It is provided with adjustable bushings on the worm and sector shafts. The rod connecting the steering gear with the knuckle is provided with coil springs to relieve the steering gear of shocks.

American Locomotive Company's Three-ton Truck.

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WELLS-FARGO COMPANY BUYS WAGONS.

SOME years ago, when the Adams Express Company invested half a million dollars or so in motor wagons and scattered them throughout the eastern country, competing establishments of large calibre thought little of the matter, or if they did, gave no sign of following a course of action so bold. As time went on, however, the work of these machines began to be conspicuously noticeable. Their constancy in operation and economy in service was much admired, and the investment assumed a new importance for the company's rivals. Two things were very evident, namely, that the work capacity of the machines was of a very superior order, while the expedition with which deliveries and collections could be made touched those using horse-drawn wagons in the tenderest spot of their commercial makeup.

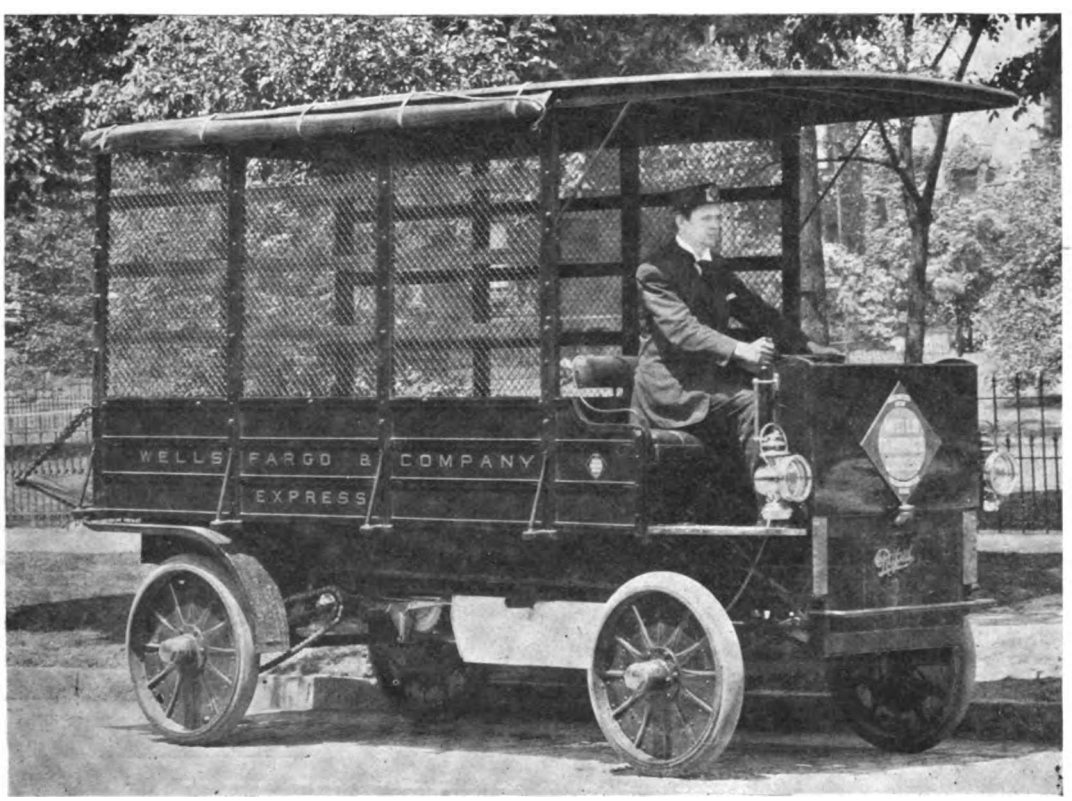
Virtually the Adams Company forced its competitors to the employment of the modern means of road transportation. Slow expressage is not profitable, and, even if motor wagon service did not yield a handsome economy when compared with draft animal transportation, it is likely that it would be employed by those who are compelled to live out of the celerity of road transportation service. It is sheer necessity which causes express companies to adopt the motor wagon.

The Wells-Fargo Express Company is now following the lead of the Adams, American and United States companies, and thus practically the whole group of large express operators may be said to have indorsed the utility of the motor wagon. In Cleveland the Wells-Fargo Company operates a Rapid truck which is shown in the illustration on this page. A similar machine is used by the company in Pittsburg, and within a short time two or three additional machines will be purchased for other centers of industrial activity in which the company operates. The vehicle illustrated is furnished with a 30 h.p. double-opposed engine, giving a maximum speed of 20 miles an hour. Back of the driver's seat the platform extends 10 feet. The wagon is 6 feet high and 5 feet wide.

A typical day's work of the Cleveland machine is as follows: Leaving the office at 8:35 in the morning, and making 54 deliveries, it returns at 1:45 in the afternoon, having covered 32 miles. In the afternoon the machine leaves the office at 3:10 and covers 24½ miles before 6:25 in the evening, making 40 deliveries, the total daily work averaging about 56½ miles and 94 deliveries. This is accomplished by the consumption of 6 gallons of gasoline at 65 cents, half a gallon of lubricating oil at 20 cents, and driver's wages at $2.50. Maintenance and administrative expense, of course, are not figured in this estimate of working expense. The Cleveland machine has replaced six horses, one wagon and one driver, and obviously gives greater efficiency at lower cost.

It is expected that motor buses will be operated by the Baton Rouge & Hammond Railway Company connecting Covington, Hammond and Baton Rouge, La. The train service is slow and unsatisfactory.

There is strong likelihood that motor buses will be in operation between Denton and Decatur, Tex. Railroad service between the two points is extremely poor, it being necessary to travel 80 miles in order to bridge the 28 which separate the two points.



Wagon in Service of Wells-Fargo Express Company in Cleveland.

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BAKERS BUY TWENTY ELECTRICS.

THE Ward-Corby Co., wholesale bakers of Chicago, have ordered twenty half-ton electric wagons from the Pittsburg Motor Vehicle Company. The machines can cover 40 miles on a single battery charge at a speed of ten miles an hour. When the new equipment is installed the bakery company will have 36 Pittsburg wagons operating in various parts of the country in which it transacts business, 16 having been in use for three years past. The Chicago machines will be employed in the service of the new south side plant, which the owners will open next December.

IMPROVING THE KANSAS MAIL SERVICE.

EXPERIMENTS for the improvement of southwestern Kansas and southeastern Colorado mail service were recently conducted in Syracuse, Kansas, with the aid of two motor wagons, each of which traveled 135 miles between 7 in the morning and 6 in the evening. On each trip eight postoffices were served. The collection and distribution extended to more than 150 ranchers and claim owners. These journeys heretofore have required the service of three horse drawn vehicles, 11 teams and three drivers. The demonstration machines were of the high-wheeled type. The route traversed extended through four counties in Kansas and two in Colorado.

MACHINES IN BUFFALO MAIL SERVICE.

POSTMASTER Greiner of Buffalo is so well satisfied with the economy and superior advantages of motor mail collecting wagons that, after a month's test, he is about to recommend their extensive employment. The tests, which were carried on in accordance with orders from Washington, showed that one machine and one driver can do the work of two horses, two wagons and two drivers. The expense of maintaining the machines is shown to be no greater than that of caring for twice as many horses and wagons, while the efficiency of the service is much greater.

CAB COMPANY'S CAPITALIZATION REDUCED.

THE registered capital stock of the Chicago Taxicab Company is now $500,000. Formerly it was $2,000,000, which, as remarked before, was much greater than either its equipment or its business justified.

The fire commissioners of Elizabeth, N. J., are about to petition the city council for an appropriation to purchase a motor driven fire engine costing $8,000.

The Fort Worth (Tex.) Taxicab Company has been chartered with capital of $10,000.

The emergency police automobile used in Cincinnati, which cost $5,000, is to be converted into an ambulance. It is fitted with a 70-hp. engine.

A "horseless Sunday" is being urged in London.

REVENUE FROM MOTOR CAB SERVICE.

RECEIPTS from the traffic of the machines employed by the General Motor Cab Company of London for nine weeks ending July 3, were as follows:

Week ending May 8	$ 82,886.40
Weed ending May 15	82,214.40
Week ending May 22	89,832.00
Week ending May 29	98,097.60
Week ending June 5	78,537.60
Week ending June 12	98,971.20
Week ending June 19	103,060.80
Week ending June 26	93,801.60
Week ending July 3	95,260.80

The total receipts from August 1, 1908, to July 3, 1909, amount to $3,397,910.40. No information is available concerning the number of machines which were employed in order to derive the weekly revenue above given. It is generally believed, however, that the company has about 2,000 machines in service.

NEW CAB RATES IN PROVIDENCE.

BOTH branches of the city council have acted favorably upon an ordinance regulating motor cab traffic in Providence, R. I. The measure provides for a charge of 50 cents for a distance not exceeding one mile for one or four passengers and 10 cents for each additional quarter mile or fraction thereof. Hire by the hour shall not exceed $3 for the first hour and $2 for each subsequent hour. No charge is to be made while going unoccupied between the garage or public stand and the place ordered, unless the distance exceeds two miles, in which case the charge shall not be greater than 20 cents for each mile in excess of two miles or fractional part thereof. A rate not to exceed $1 an hour is established when the vehicle is kept waiting. For weddings, parties, or theaters the fare for one to four passengers inclusive shall not exceed $3.

A reduction in license fee to $3 is provided. The license to drive is 50 cents. A change in the registration is also provided by doing away with the red number plate and substituting a number on the side lights.

The old tariff was 75 cents for the first mile and 25 cents for each succeeding mile, and $5 an hour for the first hour and $3 for each succeeding hour.

MOTOR CABS IN NEW ORLEANS.

MOTOR cab service was commenced on July 8 in New Orleans by the Taxicab Company, Limited. Twenty-five machines will eventually be operated, deliveries being made at the rate of four a week. The tariff for the first mile is 50 cents, and 40 cents for each succeeding mile. E. R. Thomas is president of the new company. The directors, all well known in the trade, are as follows: C. B. Penny of Buffalo, Arthur W. Pope of Boston, E. R. Thomas of Buffalo, and Marcus I. Brock of Buffalo.

Efforts are being made to furnish motor bus service between Brussells, Sturgeon Bay and Green Bay, Wis.

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STRENGTH AND ENDURANCE OF AUTOMOBILES.

IT IS probable that there has never been a period of such rapid development in the metal trades as has occurred in connection with the automobile industry, says Henry Souther, expert metallurgical advisor of the Association of Licensed Automobile Manufacturers.

In America the tremendous importance of heat treatment of steel has been grasped and the principles involved therein carried to an ultimate conclusion. Intelligent heat treatment is quite as essential as the quality of steel. A commonplace steel may be given very good physical qualities by proper heat treatment, and the best of steel can be ruined by lack of it. There must be thoroughness in the various operations of annealing, hardening and tempering. Treatment carried on with sufficient care makes uniformity of product possible. How necessary this is in important drop forgings is obvious.

The difference between ordinary material and the best of material is very great. For example, the elastic limit of ordinary steel is 40,000 pounds to the square inch, with, say, a reduction of area of 50 per cent. Properly heat-treated nickel steel will have an elastic limit of two or two and one-half times this figure, and yet have a reduction of area of 50 per cent or more.

Brittleness does not follow intelligent heat treatment; and the enduring quality is increased in greater ratio than the elastic limit. Consequently crystallization, fatigue, or whatever the cause of breakage is called, is less likely to be encountered in a properly heat-treated and tempered material than in an annealed and soft specimen. This, having been discovered in the laboratory, and established in actual practice, is now accepted by the metallurgical world, reversing previous general belief.

Another commonly accepted belief has been that the stronger a piece of steel the stiffer it is; for example, that if one steel is twice as strong as another it will bend only half as much under a given weight. But actual tests have shown that a chrome nickel steel, having an elastic limit of 150,000 pounds or more per square inch, bends under a given load the same amount as a carbon steel. This is true as long as the load is within the elastic limit of the weaker material. The elastic limit of a well-tempered piece of spring steel is above 150,000 pounds per square inch. If a spring be made of soft steel and not loaded beyond its elastic limit, it would return every time to its original shape, but the deflection would not be sufficient to make a good spring; it would be hardly noticeable. The automobile industry has forced the spring maker to depart from his old materials and methods.

Assume that a good .20 carbon steel has been used with satisfaction for a year or two on a given design of crankshaft, neither bending nor breaking through long continued use. Assume the bearing surfaces are as small in area as possible to run properly. A crankshaft of highly treated chrome nickel steel, having an elastic limit four or five times as high as the .20 carbon material, would be no stiffer, but would have increased life and last much longer.

Really sound knowledge as to steel has been spreading fast among intelligent manufacturers, who use much discrimination in separating the false from the good. They have established testing laboratories and examine for themselves what materials they buy. There are, perhaps, a dozen first-class grades of steel in the market (and America has a market at least as good as any in the world, with, of course, always the option of buying abroad for any real or fancied reason) suitable for the highest class of automobile construction.

Where any form of plain journal is used the bearing metal question seems to have settled down to a high grade tin-antimony alloy, running against a soft shaft; a hardened shaft running on a good phosphor-bronze; or a soft shaft running on a white bronze. All of these combinations are giving good results.

The large part of the expense of an automobile engine cylinder is in the finishing labor, and not in the iron. In the foundries there are many complex conditions, arising from what a layman would think trifling matters, in the production of first-class cylinders.

The Taxicab Operating Company of Nashville has been organized with capital of $5,000.

The Worcester, Mass., protective fire department is to be provided with a motor hose wagon.

The Taxicab Company of Boston has been incorporated with $250,000 capitalization, of which $175,000 has been issued, all subscribed for. It proposes the installation of 50 machines.

Stirling City and Prattville, Calif., are to be linked by motor bus.

The Minneapolis Motor and Truck Company has been formed with capital of $500,000.

The licenses of 40 Massachusetts automobile drivers were revoked during the past four months, 27 for reckless operation and 6 for intoxication.

An itinerant repair man, with headquarters in Minneapolis, has discarded his horse and wagon and now makes business tours of the surrounding country in a home-made automobile.

Ironton and Proctorville, in Ohio, will soon be connected by motor bus.

There is a strong prospect of operating motor buses between Santa Fe and Farmington in New Mexico. It takes two days to go from the capital to Farmington by rail, a distance of 350 miles, and it is claimed that a motor bus line would reduce the distance to 180 miles and make it possible for the tourist to take breakfast at Santa Fe and supper in Farmington the same night.

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ANOTHER NEW MANUFACTURING CONCERN.

THE Bailey, Carroll & Kline Company has been organized at York, Pa., with capital of $100,000, to manufacture commercial motor vehicles. The company was organized by J. A. Kline, formerly manager of the York Motor Car Company, and S. E. Bailey, formerly president of the York Motor Car Company. Others interested in the concern are Joseph D. Carroll, treasurer and secretary of the Fiss, Doerr & Carroll Company, of New York City, which firm is widely known as the largest dealers in horses throughout the country, but which two years ago, by buying and leasing motor wagons, evinced a disinclination to be eliminated from the transportation world after its reputation therein had been strengthened by long years of operations.

The officers of the company are as follows: S. E. Bailey, president; J. D. Carroll, vice-president; J. C. Schutte, secretary; George W. Ryan, treasurer, and J. A. Kline, general manager. The company has completed the erection of one building, 200 by 50 feet. Ground has been broken for another to occupy 115 by 80 feet. In addition to these buildings the company will also operate the plant of the Kirkman Motor and Parts Company, of Bath, N. Y., which will be used for the production of motors, transmission and other parts.

TO MAKE ELECTRICS IN WASHINGTON.

ELECTRIC wagons of all sizes will be manufactured in Washington, D. C., by the Pittsburg Motor Vehicle Company, which concern has the following officers: President, Arthur C. Moses; vice-president and general manager, W. H. Conant; treasurer, H. E. Leary; secretary, Stanton C. Peelle; directors, Byron S. Adams, R. P. Andrews, F. W. Bolgiano, Jules Demonet, A. F. Jorss and John J. Knox.

FORD TO MAKE FARM TRACTORS.

EXPERIMENTS are being conducted in the Ford factory at Detroit with gasoline farm tractors. The first model consists of a combination machine for harrowing, seeding and rolling, the plow leading. It worked satisfactorily on acreage owned by Mr. Ford. It is provided with a four gang plow. It is likely, however, that the next model will be equipped with a six gang plow.

The Hancock-Berkeley Automobile Rapid Transit Company has been organized to transport passengers and parcels between Hancock, Md., and Berkeley Springs, W. Va.

One of the most interesting features of transportation in Texas is the automobile line between San Angelo and Big Springs, a distance of 100 miles. In addition to the passengers each car carries, the line is responsible for the transportation of mail between the two communities. The mail bags and hand baggage are carried on the hoods of the machines.

NEW SITE FOR SMITH FACTORY.

FOR some time past the business of the A. O. Smith Company, parts makers of Milwaukee, has been growing at such a rate as to overtax the capacity of its building on Clinton street, and on that account the operators have been endeavoring to secure a site for the erection of a new and larger building. A deal has just been closed whereby the company comes into possession of 20 acres of land just outside of the city limits, upon which will be built a factory, involving the expenditure of $500,000. The plans call for the construction of a main building 800 by 285 feet, and one story in height. The present plant, which will not be abandoned when the new buildings are completed, employs 800 men.

TO MAKE TRUCKS AND CABS IN DAYTON.

THE Courier Car Company has been organized with capital stock of $200,000 to manufacture commercial motor vehicles in Dayton, Ohio. The firm will produce trucks and cabs. It will occupy the plant of the Kinsey Manufacturing Company. The incorporators are C. G. Stoddard, H. W. Hayden, John F. Campbell and H. J. Edwards. All of the incorporators are officers of the Dayton Motor Car Company. Active operations will not be commenced until the fall.

RELIANCE PLANT TO BE ENLARGED.

ARRANGEMENTS are being made for the enlargement of the Reliance plant at Owosso, Mich. New buildings are to be erected for the various models now being and later to be manufactured. When the work of construction has been completed the plant will have a capacity five times greater than at present and each model will be assembled in a building erected for that special purpose.

TO MAKE WAGONS IN ELKHART.

LIGHT gasoline wagons will be made in Elkhart, Ind., by the Industrial Automobile Company, the experimental model having recently made its appearance. The machine is equipped with a 14 hp. double opposed engine, is gear driven, and fitted with multiple disc clutch and sliding gear transmission.

Hazelton, Pa., is to be provided with a motor hose and chemical wagon.

CLASSIFIED ADVERTISING.

Advertisements under this heading are charged for at the rate of three cents a word, including address; minimum charge $1 for each insertion; no illustrations; cash must accompany order.

WANTED—A man of large calibre as general superintendent of motor truck manufactory. One who can handle a large proposition and assume responsibility for its success. Fine opportunity for a man with exceptional ability. Kindly state previous associations. Address reply to R. C., care the "Power Wagon," Metropolitan Block, Chicago, Ill.

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The Power Wagon

A Journal for Those Employing Commercial Motor Vehicles

No. 58 | SEPTEMBER, 1909 | No. 58

PUBLISHED THE FIRST OF EVERY MONTH BY

THE POWER WAGON PUBLISHING CO.

SUBSCRIPTION RATES:

One Year (Domestic)	$2.00
One Year (Foreign)	3.00
Single Copies	.20

PUBLICATION OFFICES:
THE METROPOLITAN BLOCK
Chicago, Illinois.

Advertising Rates on Application

WALTER WARDROP, Editor

Entered as Second-Class Matter December 2, 1907, at the Postoffice at Chicago, Ill., Under the Act of Congress on March 3, 1879.

Underworked Machines

The service of few motor wagons employed in private service approaches their potential work capacity.

EXPERIENCE is a valuable asset in the operation of industrial motor vehicles. If it is not exactly indispensable for their successful administration, at least those who possess it may be said to be incapable of committing the small follies which so frequently attend the prosecution of mechanical road haulage.

The natural tendency of nearly all inexperienced owners of such machines is either to misapply or underwork them. The former of these errors in judgment was a notable characteristic of the early period of the machine's employment. It is not so prevalent today, though it has by no means disappeared. Improvement in this respect is chiefly due to the alertness of motor wagon makers, who no longer desire to sell machines for service to which they are poorly adapted. Necessity frequently impelled even the most intelligent producers to fill orders which they knew would not be altogether creditable, but as some slight economy could be derived from using the machines remonstrance against their purchase was not very vigorous. Use of any kind, even of the clumsiest, was better than no use at all. The end to be accomplished, distribution of product, justified the means often employed.

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The underworking of a motor wagon, however, is an administrative fault which its maker cannot so readily correct. It is a habit deeply rooted in all establishments where road transportation is only a minor feature of the business, and is directly traceable to the inherited practice of working draft animals well within their safe capacity. Constantly urged to its limit of endurance the horse soon becomes a bad investment. Work, and plenty of it, is the prime factor in the machine's success. Gross expense of machine maintenance will, of course, increase with the rise in mileage and tonnage, but the net cost of haulage will decrease.

Theoretically, and even with considerable frequency in practice, a gasoline wagon, which is geared to make 12 miles an hour at top speed, should, making due allowance for loading, unloading and rest intervals, travel between 65 and 75 miles in the course of an eight-hour day in uncongested city territory. With special facilities for loading and unloading the mileage might be considerably higher. But in ordinary practice the range seldom exceeds 40 miles. This is a sign of bad adaptation. Similarly with electric wagons. They are rarely worked to full capacity, either of mileage or load and irrespective of battery boosting or exchange.

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The underworking of a motor wagon, while not a principal fault of administration, has the disadvantage of making it seem that the machine's potential capacity is no greater than its daily performances. Probably this state of affairs will remain undisturbed until motor road transport is specialized by professionals who will work their equipment to the limit of its capacity. Meanwhile, one regrets to observe, the tendency of private practice in the operation of motor wagons is to obscure rather than define the advanced administrative methods which are required for realizing their maximum economy.

BIG ORDER FROM SOUTH AFRICA.

THE R. L. Morgan Company, of Worcester, Mass., has received a $350,000 contract from the American-South African Commerce Company, of Johannesburg. This is the largest order for machines of this class ever placed and is the second largest order in the history of the industry. The machines will be used in the mining and developing business of the purchasers, hauling ore and supplies. The buyers sent a representative to this country in the person of General Samuel Pearson, widely known as purchasing agent of Krupp guns for the Boer army in the recent Boer-British war. Motor road vehicles of all kinds are badly needed in South Africa, owing to the ravages of a cattle plague. Transportation animals are literally dying by the thousands.

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Machines in Army Maneuvers

Brilliant work of motor batteries and machines attached to quartermaster's department in recent war game.

VERY substantial proof of the military motor vehicle's usefulness was afforded last month in the course of the mimic war maneuvers. The work of the 25 machines employed in transporting food and other supplies, and in battery and hospital service, was so impressive as to excite the greatest astonishment among army officers who have speculated to some extent upon the advantages to be derived by the substitution of machines for mules and horses in military operations. This was the first practical demonstration which the army authorities of this country ever undertook in order to test the value of motors under conditions which might be expected to prevail in time of war.

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For theoretic purposes Boston was supposed to have been the object of attack by 4,000 troops. Assailants and defenders were each assigned a motor truck equipped with a rapid-fire gun. These machines were screened with foliage so as to conceal their true character. The speed with which they moved from one point to another was often of great value in reinforcing hard pressed detachments. In this service they proved to be much superior to horse-drawn batteries. Their work was not confined to roads. Frequently they were driven over vacant lots and fields made soggy by the heavy rains which fell during three days of the maneuvers.

The rapidity with which the rapid fire guns mounted on motor trucks could be brought into action and moved out of range was commented upon with especial favor by the artillery experts. One smiles upon learning that one of these formidable machines, stripped of its quick firing gun, is a Packard three-ton truck which is regularly engaged in commercial service in Boston, while the other, a Frayer-Mille product, is a three-ton express wagon.

* * *

The work of the attacking army's motor battery provoked the most enthusiastic comment. Its mobility proved that it was a very deadly instrument. It was demonstrated that it could wipe out battalions of a regiment from in front, then bear around and trim down a right flank, and also circle around and get at the rear guard before the enemy knew what was happening. Only military men and gunners can appreciate what having a gun on a motor truck means, for horses are extremely difficult to handle, fall and meet with accidents, in addition to being dropped by the enemy's bullets. The umpires declared that had it not been for this truck one regiment would have been completely annihilated. In this particular instance, had the truck with its gun not reached the ground at the crucial moment—a feat impossible for horses—the defending army would have won a signal victory. In other encounters it was estimated that this one truck did the work of a whole battalion of artillery. Driving across fields and acres of soft cranberry bogs it would seize a point of vantage and start blazing away long before the artillery divisions could be lined up. The most remarkable thing about it was that it would go forging ahead through soft spots, when heavy and light artillery would be stalled in the deep mud.

* * *

One point which was especially made manifest was the feasibility of transporting a regiment on a forced march with the aid of a number of motor trucks. One of these was found capable of carrying 40 men with guns and haversacks over more ground in two hours than it would take infantry a whole day to get over. If, in such cases, 30 trucks were available, a whole regiment of infantry and its baggage could be transported between 50 and 75 miles in a single day.

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The quartermaster's department was supplied with 20 Autocar trucks. When the attacking army changed its base these machines were worked with great activity. Like the battery machines, they had to contend with unusual difficulties during the rainy period of the maneuvers, at times traveling axle deep through mud. The high load capacity and superior speed proved of great advantage, and experts freely admitted that it would have been impossible for horses to have so expeditiously performed the work assigned them, or to have rendered such effective service at critical moments.

The maneuvers lasted for a week, during which time about 100 motor vehicles of all kinds were pressed into service. Staff officers, umpires, observers and advisors of the respective armies used touring cars. The medical department employed steam driven motor ambulances. General Wood during the course of the week traveled 150 miles a day, keeping in touch with the commanding officers of both forces. Hostilities opened at 5 o'clock in the morning and ceased at 1 o'clock in the afternoon.

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The war authorities now have in front of them all the evidence which is required to show that the problem of an army which depends upon horses for its field transportation are radically different from those which are presented when machines are employed for the same purpose. It may be said that the calculations required in the former case are 99 per cent accurate. Long experience has established sound practice for moving troops, ammunition, stores and supplies by horses. An army equipped with motor vehicles can make little use of this experience. Troops in good physical condition will march 2½ miles per hour, making about 15 miles a day. The 192 commissary wagons and 72 hospital wagons of a division train will stretch out for a distance of 15 miles. Each of these horse-drawn vehicles, to maintain its proper distance in the line of march and not cause traffic confusion, requires 60 feet of road space. Hitched to a four-mule team each is capable of transporting a 2,500-pound load, of which about 50 pounds is provender for the ani-

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mals. If motors were used a three-ton truck, traveling about 12 miles an hour, would occupy 20 feet of road space. Thus the length of a division motor train would be two-thirds less than that of one moved by horses. In a full day it would be possible to travel 280 miles, or 18 times as much as a horse train could cover.

* * *

Employing horses for transportation an army cannot be located more than 30 miles from its base of supplies, for this is the maximum distance of which horses are capable of hauling loads in the course of a day. If a division happens to get 45 miles away from the army base it will run out of supplies in eleven days. Using machines for the transportation of supplies, an army can easily be maintained and kept in communication with its base 150 miles away. The strategic advantage of extending the area of operations is too obvious to require comment.

Military experts now believe that an army should have a central field base, with the troops located 25 miles in the direction of the enemy. To transport supplies to the advance line three-ton motor trucks might be employed. Machines of lower rating and greater speed could be used to distribute supplies from the advance line to the scattered camps and outposts. This was the system of distribution employed by the attacking army in the recent maneuvers, and it worked so well that at the end of two days horse service was discontinued. One night a three-ton machine carried a load of beef for a distance of 71 miles. Rain put the roads in very bad condition. In six days this machine covered 422 miles under load.

MOTOR TRUCKS FOR HAULING ORE.

WITHIN the last two years a very considerable number of motor trucks have been sold in the western and southwestern mining regions. The equipment which the Utah Gold and Copper Company is about to install at its mine in Tremont, Utah, may be considered as typical for this class of work. Four machines are needed to haul the ore from the mine to the railroad. Each machine will pull a trailer. The total load will be five tons, evenly distributed on each vehicle. It is a 30 mile haul from the mine to the railroad by the new wagon road which has recently been constructed. Two round trips can be made every 24 hours. It cost $6 a ton to haul the ore by horses or mules. By the introduction of machines it is expected that a saving of at least 25% will be effected. The machines will be used until a railroad to the mine is completed.

Six motor busses are operating between Lakeview and other Southern Oregon points and the railroad at Alturas, Calif. Mails and passengers are carried.

An electric hose and chemical wagon will be supplied to the University of Illinois at Urbana. It will be capable of traveling 65 miles on a single battery charge. Its top speed is 20 miles an hour.

THE WASTEFUL HORSE.

THROUGH centuries of inherited practice we have become so familiar with horses that the aggregate investment involved by their employment is rarely estimated. The number of horses in the United States at the time of the last census was upwards of 22,000,000, representing an outlay of two billion, two hundred million of dollars.

The closest estimate of the number of horses employed in the Borough of Manhattan in New York state is 400,000. Of this number fully 20 per cent die or are otherwise disposed of annually. The original cost per head will average $200, giving an investment of $80,000,000. Allowing 20 per cent for depreciation, we find the horse owners collectively must charge off the sum of $16,000,000 annually. The interest on the investment at 6 per cent amounts to $4,800,000. None of these figures include other contingencies. At least 100,000 of the above number are employed in handling merchandise.

The annual average costs in New York are:

Board at $300	$30,000,000
Stable rent at $40	4,000,000
Doctor's bill at $4	400,000
Shoe bill at $25	2,500,000
Total annual cost	$36,900,000

excluding wagons, harness and losses by death.

But this does not represent the tributary costs. Horse manure forms at least 80 per cent of the street sweepings; watch any street sweeper and you will see that he is sweeping up horse manure.

The street cleaning costs for sweeping	$2,134,000
Carting	1,750,000
Final deliveries	1,161,000
Incidentals	935,000
Total	$6,000,000

And this is not all. The cost of maintaining hospitals in the same city is about $4,250,000.

The annual loss of human life, traced to diseases caused by breathing the dust of pulverized horse manure is 20,000 persons. The economic value is $2,500 per capita based upon New York statistics, or $50,000,000 annual loss.

The annual saving by motor wagon delivery to replace 100,000 horses is directly estimated at $100,000,000.

The extra cost of living due to horse deliveries in New York City at 10 cents per capita is $4,300,000 per year.

A motor hose and chemical wagon has been installed in Fall River, Mass.

Wheeling, W. Va., will soon possess a motor hose and chemical wagon.

The "consumeter" is an instrument which gauges the consumption of gasoline and indicates the quantity in the fuel tank at all times. It is used abroad.

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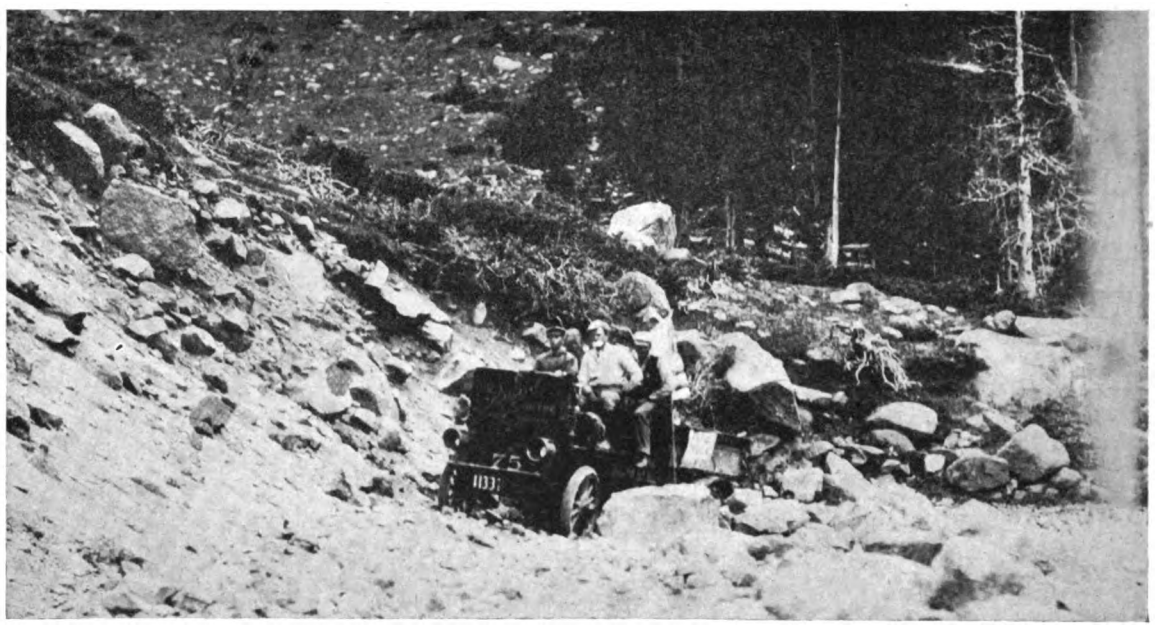

Sample of the difficulties encountered by Rapid motor wagon in ascending Pike's Peak. Rocks and boulders washed down by rains covered the path.

Motor Wagon Ascends Pike's Peak

Rapid company's machine the first commercial vehicle to climb this mountain--28 hours required for the journey.

DRIVING a motor wagon up the boulder strewn trail which leads to the summit of Pike's Peak in the Rockies is a performance which only the most venturesome would care to undertake. In the course of the ascent there is constant peril, while in descending the greatest care has to be exercised in order to avoid slipping over one of the many precipices which mark the way.

The first commercial motor vehicle to negotiate this difficult and hazardous 18 mile journey to the clouds was a product of the Rapid factory. It was in charge of J. P. Myers, sales manager of the company. The ascent, made on July 26 and 27, required 28 hours. The return trip was accomplished in four hours. The driver was Frank Grogan. The other members of the party were James Curry, a mechanic, and a photographer.

* * *

The machine which performed this notable journey was the one which accompanied the Glidden tourists. It is rated at one ton. The following graphic narrative of the ascent is furnished by Mr. Myers:

"In Colorado Springs we were advised to abandon our plan, as there was no regularly used road and we were almost sure to encounter obstacles which it would be impossible to overcome. However, we set out at 5 in the morning. We gradually rose until we reached the Cascade, and by that time we were climbing a typical mountain road which wound in and out of the foot hills of the Rockies, crossing a stream here and bordering an awe inspiring cliff there. A little over half way up the mountain sides were covered with snow, and the pinnacle was shrouded in clouds.

"As we knew nothing of mountain climbing, we did not realize what lay between us and the end of our journey. After eight miles of the stiffest climbing I had ever encountered in an automobile we met a miner and learned that we had lost our way. We retraced our tracks for about three miles and then followed the right trail. The grade was quite steep, as you may imagine. Our path at this point was gravel, studded with partially embedded boulders and strewn with logs. At an altitude of 11,000 feet we reached the timber line, above which no animal or vegetable life exists on the mountain. When we had passed the timber we encountered snow. Our path now ran along the edges of precipices, and as we went along the route became more difficult. In several instances we had to drive a crow-bar between the boulders, attach one end of a rope to the wagon and wrap the other end around the crow-bar and draw it back, to hold the car from sliding over the side of the mountain into the depths below. These places were the most dangerous part of the entire trip, as the soil consists of a loose gravel that did not support the weight of the machine and we had a hard time preventing it from turning over and getting away from us. A space of three inches was often our margin of safety, and even had we desired to turn back we could not have done so.

* * *

"By this time the altitude began to have its effect on two members of our party, and we had to lay them on the floor of the wagon. The boulders increased in size as we ascended, and the unusual exertion of moving them in the rarified air weakened every member of the party. The temperature dropped to the freezing point, and we were filled with dismay when we found that we were only half way up and night coming on. We had not brought blankets or food and only three of the party had covering as heavy as a light rain coat. After consultation it was decided to pile rocks behind the machine and walk to the

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top of the peak, and return next morning and complete the journey.

"Three of us, being in better shape than the other two, decided to send one man ahead by himself while each of the others who was physically fit started up the trail. Darkness descended rapidly and within an hour we were completely enshrouded in clouds. It kept getting colder and colder until we were so numb that speech was almost impossible. In the complete darkness of the clouds it was only a few moments before we were separated, and, as I learned afterwards, all of us lost the trail. As the rest of the party had an experience practically the same as mine, I will tell you what occurred to me.

* * *

"The young man whom I was endeavoring to assist continued to get weaker, and my own strength began to ebb away. A wind arose until it was virtually a hurricane. Walking was most difficult, as we could not proceed three feet without bumping into a boulder or falling painfully on the wet rocks strewn about. When completely overcome with exhaustion we laid down, seeking what shelter might be obtained from the lee side of a rock. With teeth chattering and limbs numb, we huddled together, and when the cold became unbearable we would get up and walk until again overcome with fatigue. To enhance the danger of our situation, the wind changed every few minutes and sometimes almost forced us over the cliff upon the rocks below.

"Of course sleep was impossible under such conditions, but fortunately we occasionally lapsed into unconsciousness, which served to shorten the hours of the longest night I have ever known. When it seemed as though we could not stand it any longer a gray haze appeared in the east, announcing the approach of day. The darkness gradually disappeared, and the cold rain stopped. Utterly exhausted, rain-soaked and benumbed with cold, we dragged ourselves across and around boulders until we came to a trail that led up to the peak. We were struggling to breathe. It was possible to proceed only a few feet at a time until we were forced to sit down and rest and summon courage enough to proceed a little further. About 7 o'clock we met two other members of our party, who were in the same condition as ourselves. We joined forces and continued our climb together, each rendering the other such assistance as lay within his power.

* * *

"It seemed ages before we reached the little building on the peak known as the Summit House. Hot coffee and a rest of an hour revived us. Then we learned that our driver, who had gone ahead the night before to get assistance, had not put in an appearance. Searchers were hired and after about three hours work they found him manfully struggling to reach the top and secure aid for the rest of us. After another hour's rest we walked back to our machine, which we were surprised to learn was within three-quarters of a mile of the top of the mountain. The boulders had increased to prodigious size and we did not reach the Summit House with the machine until noon.

"After taking photographs we started downward on the most nerve racking trip of my life. It seemed that we would never be able to get the machine to the bottom without slipping over the side at one of the innumerable places where the trail was so narrow that passage seemed impossible. At 1 o'clock next morning we reached Colorado Springs."

Commercial motor vehicle owners in Leavenworth, Kan., are now required to pay a license fee of $10 for each machine.

Rapid motor wagon at the top of Pike's Peak.

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Street Cleansing Machines

Experience of an English municipality with motor wagons designed to haul refuse and cleanse streets.

IT MAY easily be believed that if municipal motors of certain kinds were more extensively used in this country there would be no occasion for proving their economy by existing records of foreign service. Street cleaning and refuse collecting machines are practically unknown here. In England, however, they are very justly pronounced to be excellent municipal investments. What can be accomplished with such machines is very well illustrated by the testimony of the chairman of the highways committee of the Westminster council, who says:

"In presenting a short notice on the employment of motors in the cleansing department of the city of Westminister I think it would be useful if I give a general outline of our practice. The city council possesses eight motors altogether: three Thornycroft steamers; four Leyland steamers, and one Thornycroft gasoline motor. All are fitted with interchangeable dust and watering bodies. All the steamers have rubber tires on the driving wheels, and the gasoline motor has rubber tires on all four wheels.

* * *

"The city council passed a resolution that, in view of the large amount of night work done by the motors, they shall be furnished with rubber tires, but it is not yet possible to give exact figures as to cost under this head, as the first pair of tires were fitted in October, 1907, under a guarantee of 10,000 miles, but these are not yet worn out, although they have run about 16,000 miles. In addition to the silence at night, the rubber tires have proved to be absolutely essential for snow removal, as the motors proved totally unable to travel without them. With the rubber tire, no difficulty has ever been experienced under any condition of the roads. The motors are used at night for soaking the streets preparatory to flushing, and in the day-time for dusting and street watering.

"The council resolved that the removal of house refuse shall be effected throughout the city, by means of a daily collection, before 10 o'clock in the morning. It has proved a very lengthy piece of work making the arrangements for this, but it has now been accomplished in the greater part of the city, and no extra expense has been involved over the old weekly collection carried on throughout the day.

* * *

"The first of the council's motors was bought in 1900, but it was two years old at the time; the vehicle is still in serviceable condition, and would fetch a fair price if sold today. This is a point of extreme interest to municipalities, as it shows that the first-class life of a good motor is certainly not less than 10 years.

* * *

"The notion was formerly prevalent that motors could not be used economically unless they were worked continuously day and night, but, on reflection, it would be seen that this is a fallacy. The expense of keeping a motor standing after it has worked one shift is only the interest on the capital locked up, for it may fairly be assumed that the wear and tear and depreciation is proportionate to the actual mileage run. The motor, therefore, possesses the advantage of great elasticity as regards work. It may be either run an ordinary shift, a shift with two or three hours overtime, two ordinary shifts with or without overtime, or three shifts, so that it can be adapted to the varying requirements of the seasons.

* * *

"In computing the work done by motors in comparison with horses I put forward the following estimate which may be treated as a conservative one. For street watering, the motor is equal per shift to 2½ horses and 2½ men; for dust collection the motor is equal per shift to 2½ horses and 1 man; that is to say, the horse for dust collection has the advantage of the additional number of drivers employed, who can act as 'fillers' also. At the same time, the advantages of the motor for speed in clearing shop streets, where the collection has to be effected with great rapidity, are undoubted. As an instance of what may be effected, Bond street has to be cleaned in three-quarters of an hour, viz.. from 9:15 to 10 o'clock a. m. This is owing to the late arrival of the shopkeepers rendering it impracticable to procure the dust before. A total of 300 tins has to be emptied in this time—a piece of work which it would be almost impossible to do with horses.

* * *

"Trailers are largely used with the motors, and are very convenient as they can easily be dropped in some suitable corner until the motor has taken up its load; they are then attached and filled up. The horse brooms are also used with the motors, but the present pair-horse brooms seem to be not sufficiently large for the motors, and the highway committee is now considering the question of procuring a large type of machine broom. We are arranging to have our watering bodies fitted with trailing eyes, so that the horse broom can be fixed on behind the watering body, as, at present, there is sometimes a loss of time in changing to the dust body when the machine broom is used. The method of changing the bodies is by means of a fixed ledge at the back of the shed, or trestle, and a sling from the roof. The body is raised by means of the tipping screw, until it takes a bearing on the back ledge and is sufficiently high to enable the sling to be hooked on to it. The screw is then lowered, and the motor draws out and backs under the other body. The change can be effected by the drivers single-handed in six or seven minutes.

* * *

"One minor matter that has given us some trouble is the want of any reliable mileage meter, as there does not appear to be one on the market which will stand the vibration of heavy motors. There is also the difficulty of getting a meter which will not deduct the backward run-

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ning, as in watering the amount run backwards is considerable, so that a certain amount of estimating has to be done to get the correct mileage.

"In conclusion, I would like to point out that the success or non-success of motors for municipal work depends as much on the organization and system under which they are employed as on the construction of the machines themselves. Although Westminster cannot claim to be the first municipal body to employ motors, yet we were one of the earliest, and I think we can claim to be the first in England at all events to employ rubber tires, and the experience we have gained contributes largely to the successful use made of them.

"I am of opinion that the most satisfactory method of running them is by a maintenance contract, as the continual bringing up before the committees of a public body of all small items for repairs and replacements leads to endless discussion and friction, and frequently a motor may be out of service for some days or weeks on account of some trivial matter which the committee may not have approved. Maintenance contracts should be on the broadest lines, and be free from restrictive clauses, for the makers should realize that their client is practically a co-partner with them in the upkeep of the machine, and that no public body would be likely to overstrain its vehicles, as any ill-usage would preclude them from arranging for a favorable continuance of the contract.

"I trust these remarks will draw attention to the absurdity of continuing to employ the horse as an instrument of municipal cleansing, especially in the great cities, where so large a proportion of the traffic is now mechanically drawn. Not only do the horses employed in cleansing foul the streets considerably, but additional ones have to be employed for drawing their forage and clearing away their manure, and these in their turn add their quota to the general filth of the roadway."

The sum of $17,000 is tied up in the construction of a motor fire vehicle being exhibited by a Pittsburg concern. It is equipped with a 115 hp. engine, carries 1,000 feet of hose, and can easily pump a stream of water 200 feet high.

WAGON FOR MOVING PICTURE SHOW.

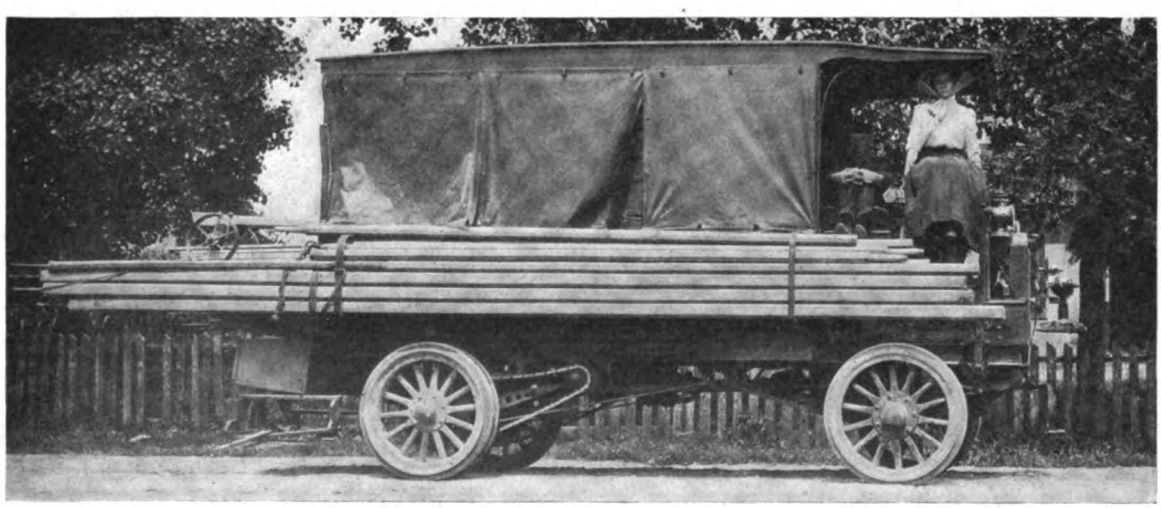
HOWEVER well accustomed one is to speculating upon the catholic character of the service in which the motor wagon may be employed, he is frequently surprised at the oddity of the work it is sometimes called upon to render. The auxiliary uses of the power plant are so large that when full advantage is taken of them the machine often loses much of its interest as a mere traction agent.

Some time ago Albert Taylor, of Mt. Sterling, Ohio, bought a three ton truck from John H. Blacker & Co., of Chillicothe, for use in transporting and operating a moving picture show. In the forward part of the body is placed a dynamo which furnishes light for the show and the moving picture machine, the dynamo being hitched to the fly-wheel of the motor. The vehicle also carries the tent, seats and all the other paraphernalia from town to town. When the show is over Taylor gives his customers a ride in a sight-seeing car. In this way he is able to carry the moving-pictures to small towns which are not able to support a permanent show.

WORK OF A MOTOR SALVAGE WAGON.

DESPITE the high rate of speed at which the Newark, N. J., salvage corps motor wagon is operated it has never met with a serious mishap or occasioned the least trouble to other vehicles. Its record in this respect is singularly clean. It skidded once, smashing an electric light pole and damaging its fender. That is the full extent of the mischief it has caused in eleven months of very active service. Four drivers are available for the machine, all trained at the factory from which it was purchased. The machine weighs 3½ tons and, as may be imagined, it is not an ordinary task to drive it at high speed. It has been driven as fast as 52 miles an hour. It carries twenty-four 14x16 tarpaulin covers and two large roof covers. Its work has saved the insurance companies many thousands of dollars.

A company is being formed to operate motor busses between Shelby and Bucyrus, Ohio.



Moving Picture Show Being Transported About the Country on a Motor Wagon.

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Trackless Trolley Operation

British investigators report concerning the equipment and physical conditions of European enterprises.

QUITE recently a committee was sent from England to Europe for the purpose of investigating the progress which had been made in trackless trolley transportation. This body, in the course of an exhaustive report, states that it was much impressed with the practicability of each of the various enterprises examined, and considers that by avoiding the heavy expenditure required in the installation of ordinary surface traction this method of conveyance is quite capable of supplying a sufficient service for thinly populated districts on a reasonably economic basis.

* * *

As enterprise of this character is beginning to arouse interest in this country, and promises to develop with considerable rapidity, it will be profitable to read a digest of the report submitted. The committee says:

"The three systems considered were the Mercedes-Stoll, which is in operation in various parts of Austria, and was seen in Vienna; the Filovia, used on six or seven routes in north Italy, and in Milan; and the Max Schiemann, which is employed in Germany, especially in the Rhine Valley.

"The vehicles operated under each of these systems in general appearance do not differ greatly from the familiar singledeck motor omnibus, except that they have some means of collecting current, such as a fishing rod from the roof to the electric current supply, as in the case of ordinary electric trams worked from overhead cables. But while the ordinary electric tram is able to let its used-up current return to earth through the metal wheels, the rubber-tired trackless tram has to let that current return by means of a second overhead cable running parallel with the supply cable. It appears that the principal difference among the various systems occurs in regard to the arrangement for keeping the two shoes on the two cables.

* * *

"The length of the route inspected in Vienna is about 1½ miles, where the road—of a switch-back character, having at one stretch of about 100 yards a gradient of 1 in 10—is macadamized. On this route there are two pairs of cables, one for going and one for returning cars, though elsewhere one pair is made to suffice, so that when two cars meet one has to stop and remove its connection with the wires until the other has passed. The vehicles carry 12 passengers seated, though when required an additional 12 are allowed to stand, even on the platforms, both front and back. The entrance is at the driver's end, and he attends to all the duties of a conductor as well as driver.

"The committee was particularly struck with the smoothness and comfort of riding, the spring base of the truck being very well arranged. The brakes are ample, and sprags are fitted to prevent running backward if the car is stopped on a hill. Satisfactory assurances were received as to the operation of the cars under the severest winter conditions, though it is noticed that on this particular route the cars have been running only since last October. The motors, which are each 20 horsepower, form the hubs of the back wheels, and the current is collected from the supply cable by means of a pair of wheels running on the top of the wire—a similar pair of wheels transferring the used current to the return. A weighted pendulum slung from a frame carrying these two pairs of wheels keeps them well pressed upon the wires, and the current is conveyed to the motors not by a fishing rod, but by a pair of cables which allow the car to pass to any part of the road in the avoidance of other traffic. The empty car weighs 2½ tons.

"The cost of the chassis of the Mercedes-Stoll is about $2,750, without body. The cost of the overhead construction is about $8,500 per mile, and the working expenses per car mile are: Current, $8.80; tires (total load 4.2 tons), $2.66; wages (driver only employed), $2.40; depot expenses, $0.52; taxes, management, insurance, $1.60; repairs, renewals, painting cars, and equipment, $1.06; total, $9.04.

* * *

"On the Filovia system the cars will take 30 passengers. A framework carrying two pairs of wheels, one pair in contact with each overhead cable, is employed to maintain the circuit. It is very similar to that used in the Mercedes-Stoll system, except that it is pressed by a fishing rod or boom against the under sides of the cables. There are two direct current motors of 10 to 12 horsepower each, and figures supplied by a route similar to that inspected show a working cost per car mile as follows: Cost of energy used, 0.83; general expenses, $1.18; rubber tires, renewal, $4.32; wages and salaries, $2.80; maintenance of vehicles and line, $1.24; repairs of vehicles, $0.912; total, $11.29.

"The route inspected, owned by a private company, is 4½ miles long, and the fare charged is 8 cents. The committee found the vehicles well able to reverse, turn around, and maneuvre without the trolley being removed, and to take heavy gradients over bad and muddy roads without difficulty, vibration, or noise. The practicability of this type of railless traction considerably impressed the committee. The cost of overhead construction is estimated at only $3,756 per mile, but only wooden poles were used. They were, however, found to be quite serviceable.

* * *

"The Max Schiemann system was seen working at Mulhausen. Here the contact with the pair of cables is maintained by means of a fishing rod, carrying at its extremity a pair of sliding shoes. The overhead construction is similar to that of the systems previously described. The vehicle carries about 15 passengers seated, and only the front wheels have rubber tires, so that there is considerable vibration and noise. The single motor drives

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onto the front axle, so that the steering is comparatively heavy. The design of this type, however, is stated to be undergoing radical modification. The weight of the present empty car is 2 tons (1,848 pounds)."

It is stated concerning all of the three systems that very few hitches have been reported, and owing to the comparative lightness of the vehicle the surface of the road suffers less than in the case of a service of cars carrying their own gasoline or other engines.

MAIL WAGON SERVICE IN INDIANAPOLIS.

WITH the advent of motor wagons in the mail service of Indianapolis deliveries and collections have been greatly facilitated. Forty of the downtown banks and largest business houses receive the first mail at 7 o'clock in the morning, it having been "made up" during the night. With the use of the machines these places are given their mail within fifteen minutes' time. From 7 until 8:30 o'clock the machines are used in delivering bundles of heavy paper, mail known as "ships," to the various districts of the regular carriers. These packages are picked up by the carriers at regular points, which arrangement relieves the post carriers of the burden of lugging heavy loads all over their districts, and enables them to make better time on their house-to-house delivery. Seventy-five carriers are so benefited, and thirty manufacturing firms are favored with a delivery in advance of the regular foot carrier service. On this trip the letter boxes are also visited and the mail so collected leaves at 9:45 o'clock. Between 10 o'clock and noon an additional delivery is made to the factories and business houses located at points far outside the business district.

After 5 o'clock in the evening the machines are used exclusively for collection service, the first two hours being spent in the center of the city. With the aid of the foot collectors, who get the mail from the office buildings to points where it can easily be picked up by the machines, evenings mails are assorted in time to be sent on out at 6:20, 6:40, 7 and 7:35 o'clock.

All but eight of the 755 boxes in the city are visited after 6 o'clock in the evening, a thing that was impossible before the motor service was instituted. Five horse wagons are still used to cover the outskirts of the city. These haul the mail to the improved streets, where it is taken by the motor wagons.

About 184 miles, an average of sixty-one miles for each automobile, is made every day in the nine hours. The machines travel at an average of twenty miles an hour. All the routes are so timed that they reach the office before "make ups" for important dispatches.

CAB OPERATORS TO COMBINE.

NEGOTIATIONS have been in progress in Boston for several weeks looking to the combination of the Taxi-Service Company and the Boston Cab Company. The proposal to merge the two companies originated with the former.

ECONOMY OF THE MOTOR AMBULANCE.

WHEN properly applied there are few machines which yield so substantial a return upon the investment as the motor ambulance. At first its introduction is usually regarded with suspicion, it being hastily assumed that its use is mainly attributable to a desire on the part of the police or hospital authorities to be up to date in the means of locomotion employed in hurrying the sick or injured to an establishment where they can be skillfully treated. Its speed function is very well understood, but its minor advantages, which are very numerous, are entirely concealed from all but those who control its service.

Just to show how useful such a machine really is, let us examine the performance of the one in Bridgeport, Conn. A few years ago the average of ambulance calls was about 40 per month. If they amounted to 45 it was considered a good month's work. The record is now 92 calls for one month; they average from 80 to 90. In addition to this work, the machine makes delivery of about 130 prescriptions each month, almost double the number delivered a year ago when horses were employed. In other words, the machine, having a very superior work capacity, is being used to demonstrate it.

"The point is right here," says the physician in charge of the machine. "If we didn't have the motor ambulance, how could we handle the work which comes along? A call that once took the horse ambulance a couple of hours is now attended to in less than an hour. If we did not have the machine a drug clerk, or another doctor, would be an absolute necessity. A drug clerk would require $12 or $15 a week and a doctor would not take the job for less than $25."

MOTOR TRANSFER COMPANY FORMED.

ENCOURAGED by the local merchants association the organization of the Appleton Auto Transfer Company has been effected in Appleton, Wis., with capital stock of $10,000. The company's machines will transport freight and passengers between Appleton and New London via Black Creek, Shiocton, Hortonville and Stephensville. Two trucks, a one ton wagon and a twelve passenger bus will be put in commission. Two trips will be made each day by the freight carrying machines. The manager of the enterprise is secretary of the merchants association.

TO IMPROVE THE LOS ANGELES MAIL SERVICE.

ACTING under orders from Washington the postmaster of Los Angeles is studying the possibilities for motor collection and delivery wagons in that city. Three machines will be required during sixteen hours of each day, and the contractor must furnish two relief machines for emergencies. Each machine must be equipped to carry not less than 500 pounds of mail matter, at a speed of not less than fifteen miles an hour, the contractor to furnish the drivers.

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Motor Fire Wagons

Figures which show an economy in first cost and subsequent operation and maintenance.

WHEN the first motor hose and chemical wagon purchased by the authorities of Vancouver, B. C., had been in service for a year an investigation of its economy and efficiency was ordered. It then developed that the machine, carrying two 60 gallon chemical tanks and 1,500 feet of 2½ inch hose, had within the period mentioned responded to 382 alarms and covered 750 miles. In no case did the machine fail to respond promptly to an alarm. The cost of maintenance was shown to be 60 per cent cheaper than it would have been had horse drawn vehicles been employed in similar service. As a result of this economy two more machines were purchased and placed in commission last April.

The two motor squadrons stationed at Springfield, Mass., answered 286 alarms last year, with but one failure to start, which was due to some malicious person having crossed the terminal wires in the batteries and occasioned a delay of three minutes. The machine of Chief Canterbury, of the Minneapolis fire department, was placed in service July 15, 1908, and during the next ten months answered over 300 alarms without a single failure to start. During the very heavy snowstorms of last winter in Minneapolis steam railways and street car lines were unable to operate successfully, but the chief's machine invariably did its work more successfully than the horse. The expense of this service was $6 per month. It would have cost $35 to feed the two horses which would have been required to do the same work. In consequence of the success of this machine the city purchased a motor police wagon in March of this year.

* * *

Captain Barrett of the Minneapolis fire department gives the following figures as representative of the cost of installing equivalent horse and motor fire vehicles:

First Cost of Motor Equipment.

Machines with combined pumps, chemicals and hose	$ 9,000
One story engine house	3,000
Total	$12,000

Cost of Horse Equipment.

One steam fire engine	$ 5,000
One chemical and hose wagon	2,500
Five horses at $265 each, harness, spiders, etc.	2,250
Engine house	6,000
Total	$15,750

To this advantage of reduced first cost must also be added the economy of maintaining motor fire vehicles, which, for the units given above, Captain Barrett estimates as follows:

Motor Vehicle Maintenance.

Engineer and six hosemen	$6,120
Repairs, fuel, etc	140
Total	$6,260

Horse Vehicle Maintenance.

Maintaining 5 horses at $20 per month	$1,200
Two drivers, engineer, fireman and six horsemen	8,060
Total	$9,260

One of the great advantages of the motor fire vehicle is its speed. This is especially true of the motor hose and chemical wagon. Statistics show that 70 per cent of all fires are put out by the use of chemicals with only a nominal loss; 10 per cent are put out with water at a nominal loss; the remaining 10 per cent are extinguished by water only after great losses have occurred. The losses from this last 10 per cent amounted to over $250,000,000 in 1908 in the whole United States.

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On previous occasions this journal has published particulars of the service performed by the two auxiliary motor squadrons employed by the fire department of Springfield, Mass. The cost of maintaining this service, however, has been withheld until it could be officially verified. This latter information is now available and is as follows:

Motor Squadron Upkeep.

Tires	$164.20
Fuel and lubricant	55.48
Lamp oil	4.00
Recharging gas tank	3.00
Gas generator	6.00
Repairs	85.14
Polish for brass work	10.00
Total cost for one year	$327.82

Compare this small outlay with that necessary for the maintenance of a three-horse hitch in similar service:

Three-Horse-Hitch Upkeep.

Forage	$390.00
Shoeing	140.00
Oil for lamps	4.00
Squad and exercise wagon repairs	25.00
Harness repairs	18.00
Stable tools and incidentals	9.00
Veterinary services and medicine	23.00
Polish for brass work, harness oil, soap	8.00
Total cost for one year	$617.00

But in addition to this annual cash saving of $289.18. occasioned by the retirement of an inferior horse service, the speed of the machines is equivalent to the addition of from 60 to 80 call men to the department force.

Chief Croker of New York City says that the introduction of the high pressure system will cause the retirement of the present steam fire engine and its supersession by the automobile hose wagon.

The Elizabeth, N. J., Taxicab Company has been formed with capital stock of $100,000.

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INTELLIGENT CARE OF ELECTRICS.

IT IS the criticism of an electric current supply company in Rochester that many electric vehicles are fed too much "juice," that their owners pay too much money therefor, and that the larger part of the current taken is used to the detriment of the storage battery. A low rate for current, this firm contends, induces carelessness on the part of vehicle owners as to the manner of use.

Evidently what is most needed in such a situation is a campaign of education which shall result in increasing the owners' knowledge of the proper methods to be pursued in charging the battery and handling the vehicle, bringing home to him the fact that if the vehicle in operation uses twice the amount of current it should to do a certain amount of work, owing to friction, bad alignment, and the like, the machine's efficiency has decreased 50 per cent, and the life of the battery more than that.

The experience of this current supply company with firms owning electric machines is extremely interesting. Its manager gives this account of it:

"Our company has for some time appreciated some of the difficulties that the vehicle owner labors under in getting satisfactory service out of the electric vehicle. For this reason we organized on the first of March of this year a department to give this matter special attention, and have placed in charge thereof a competent engineer of wide experience in the handling and maintaining of batteries. Investigation by this department thus far has shown conditions to be even worse than we had anticipated.

"While our electric vehicle department has been in operation for only a very short time, I wish to state a few of the important things that have been accomplished. The department found that the principal carting and trucking firm in our city had two electric trucks which had not been in operation for 8 months. These trucks, properly operated, should give us an income of from fifty to sixty dollars a month. The owners stated that the reason the trucks were not operated was the excessive cost of maintenance and their unsatisfactory performance.

"In order to place these trucks again in commission the department made this proposition to the owners: That we would fit up the two trucks in A-1 condition, and that if, at the end of sixty days' trial the owners were not satisfied with their operation there would be no charge for the repairs. If, however, the trucks were made satisfactory, we would charge the owners for only the actual material used, making them a present of the labor and current used in putting the equipment in first-class condition.

"The two vehicles were put on the street and have been in operation for two months, with the result that the customer has paid us $1,000 for the material used and is seriously considering the purchasing of additional electric trucks. The superintendent of our electrical vehicle department gave this installation his particular attention and after the vehicles were placed in commission gave personal supervision to the charging of the battery. On comparing notes he found that whereas under his supervision it was necessary to give the battery only 40 ampere-hours charge on a particular day, under the former operation and for the same conditions of running a charge of 180 ampere-hours had been used, 140 of which had been wasted and had served only to decrease the life of the battery through the softening of the plates.

"I do not wish to give the impression that it is the general practice of our garages and repair shops in Rochester to do poor work. We have in our city, I believe, as good men doing this work as in any city of corresponding size, but the trouble is that the repair shop is not sufficiently interested in the successful continuous operation of the electric vehicle, looking only to the immediate returns for the individual repairs.

"It is this careful attention to minute details that makes the success of the electric vehicle possible, and if these details are followed up there is no competitor to the electric vehicle in its own proper field."

DRIVING CHAIN SHIELDS.

CONSIDERING that the life of a driving chain is greatly prolonged, and its quietness of operation insured, by enclosing it in a properly constructed case, it is remarkable that this feature of design is not generally adopted by makers in this country. There never has been any doubt of its utility. Foreign manufacturers are a long way ahead of our producers in applying devices of this kind, not hesitating to provide any equipment which will improve the service of the machines.

One of the latest foreign machines to be so equipped has aluminum chain cases which form oil baths. Being very stoutly constructed they act as radius rods. These cases are made in four sections, two of the joints being right angled, one lying in a vertical plane, and the other in the plane that passes through the center of the chain sprockets. Chain inspection may be accomplished by removing one section of the covering, the three remaining sections being strong enough to withstand the tension.

Naked chains are a mechanical absurdity. If for any reason it is inconvenient to operate them in an oil bath, at least it would not greatly tax the skill of a designer to protect them from mud and dust.

INNOVATIONIN SELLING MACHINES.

AN INNOVATION in selling commercial motor vehicles was introduced last month by the Motor Truck Company of New York when weekly meetings were established to which the users of Frayer-Miller machines send their drivers and those in charge of the motor departments. At these meetings the little difficulties experienced in daily work are discussed, and methods for preventing their recurrence fully explained by the company's engineer, T. F. Burke. At each meeting a certain part of the motor truck is described in detail, together with its functions and bearing in relation to other parts. Such co-operation between sellers and users will unquestionably result in a large benefit to all.

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PREACHING THE GOSPEL FROM MOTORS.

ZEALOUS church workers do not disdain to use the motor road vehicle in campaigning for righteousness. Readers have already been made familiar with the useful work which a traveling evangelist is accomplishing by means of a machine equipped with pulpit and organ. Doubtless the practicability of its application was suggested by the success of previous experiments with touring cars. In Philadelphia the latter machines are so actively employed in religious work as to make it seem certain that a modification of the type will soon be permanently and extensively employed in this branch of christian endeavor. In that city the Brotherhood of Philip and Andrew and the service department of the Y. M. C. A. are co-operating in the use of machines for street campaigning. The aim, of course, is to reach non-churchgoers who are willing to listen to street preaching of good quality, especially when accompanied by music. The Philadelphia plan, which is now fully in operation, uses the pastors of the local churches for the preaching. The automobiles belong to the members of the brotherhood, who also furnish the workers to accompany each machine.

This twentieth century gospeling by automobile is not wholly a new idea. Machines first appeared conspicuous in religious work on Wall street a couple of summers ago, when the preachers who spoke to the brokers were carried thither and from point to point by automobiles. Similar use has been made of the automobile in the summer evangelistic services in Philadelphia and Chicago. The cities of Newark and Elizabeth have both undertaken street preaching from automobiles, with, however, specially employed evangelists. In Chester county, Pa., there has been some talk among the brotherhood men of using the automobile to carry lay speakers for special meetings in the country churches throughout the county on Sunday nights.

All the workers in the Philadelphia campaign are volunteers. Each of the preaching teams comprises from three to six men. There is no effort made to get a crowd of workers. The endeavor is rather to reduce the force to the lightness of a flying column. Each automobile covers three points in a single evening, averaging meetings about half an hour long. During the first week of July there were fourteen meetings held, with an attendance of 2,000 persons.

The usefulness of the gospel rail car was established long ago. Not many of them are in commission, however, their first cost being quite high. The motor gospel road wagon is a more flexible instrument, costs less, and seems likely to be very extensively used in the future.

The fire department of Milford, Mass., will soon install a $5,000 gasoline motor hose and chemical wagon. A year ago an electric hose machine was purchased.

Motor mail and passenger service is now being furnished between Placerville and Lake Tahoe.

COSTLY FIRE SERVICE.

IT IS now quite generally recognized that the employment of horses in fire department service cannot be defended either upon the score of economy or efficiency, and that only the costliness of motor vehicles, their comparative scarcity, and the difficulty of enlightening ignorant aldermen prevents their immediate adoption in every progressive town and city in the country. Of all the services in which motors are employed none is so conspicuously economical as that afforded by fire department machines. Every time analysis is made of the comparative cost of maintaining horses and motors in such work a large balance is always struck in favor of the latter. Even experimental investigation of the subject will convince the most skeptical of the superiority of the machines.

Setting aside the matter of wages, which, considering the fewer motor driven units that may be employed is of very great importance, it is found that the operation of the machines entails a singularly low maintenance cost, even when the service is quite active. Thus, for example, we find that in Lansing, Mich., one motor hose and chemical wagon which has been in service for 136 days, has responded to 71 alarms at a bare operating cost of $24.81. Contrast this with the $17,000 expenditure required for a year of horse vehicle service in Lowell, Mass., with 100,000 inhabitants. The officially verified figures of the maintenance of the Lowell horse-drawn equipment is as follows:

Wagons	$2,818.26
Shoeing	2,053.37
Feed	8,349.74
Stable Supplies	613.24
Horses	2,609.85
Veterinary	267.50

To be sure, Lansing has only about 25,000 inhabitants. But the activity of its fire department is not only less than that of the department in Lowell. It is a comparatively simple sum in arithmetic to estimate how great is the waste of public money in the latter city as a result of the retention of an inefficient and costly system of fire protection.

Property owneres are very badly informed concerning the superior economy and usefulness of motor fire vehicles. Until they are sufficiently enlightened upon the subject to compel intelligent action by their aldermanic representatives, it is unlikely that there will be more than "slow haste" in effecting progress. Something more than the mere representation of the economy and efficiency of motor driven fire apparatus is necessary to stir aldermen to action in this matter, for they may invariably point to a depleted city treasury or a scarcity of funds for special public service. In such a situation there is nothing left to do but urge the necessity for considering the adequate protection of life and property as the first charge upon municipal administrative officers. It is altogether unlikely that the body of tax paying citizens would in the least object to bearing an extra burden for whatever further protection it is possible to provide.

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MOTOR SPRINKLING WAGONS.

SOME years ago, when the motor sprinkler was first commissioned for service in an eastern city, it was thought that its adoption would soon become quite general. This expectation, which was well warranted by the behavior of the machine, is being more slowly realized than one could wish, but the delay is not disheartening.

The watering of streets and roads is only theoretically a function of municipal administration. Too often such service has to be purchased from private parties of limited means, whose area of operations is restricted and whose business, at least in northern territory, is only active for seven or eight months of the year. Park commissioners, whose jurisdiction extends over many miles of boulevards, show a keener interest in the work of such machines than private contractors, but of late years their available funds have been insufficient for road maintenance, the cost of which increases with the activity of motor traffic.

It is encouraging, however, to note that within the past few months some useful missionary work has been accomplished in this field. The Rapid company has sold sprinklers in Boise City, Idaho, and in Ishpeming, Mich. The latter sale was made to the municipal authorities. The machine will have 600 gallon capacity. It will cost $2,250 and will be equipped with a 30 hp. engine. Its service is rated equivalent to three horse drawn sprinklers, which will cause the retirement of two drivers and eight horses.

PRIVILEGES OF SIGHT SEEING MACHINES.

SIGHT seeing machines are not regarded with any especial tenderness by the officials who control traffic in our large cities. On the contrary, they are frequently the object of severe discrimination. Perhaps it is their unusual length which excites this hostility, for when at rest by the curb they provoke criticism from the owners of other public service vehicles which occupy much less room. In Detroit they are not now permitted to occupy public stands in conjunction with motor cabs. Hitherto the proprietors of such machines have paid rent to the owners of abutting property for this privilege. Possibly if cabs and sight seeing machines were owned in common, objection to the presence of the latter would not be so harshly pressed.

THIEVING CAB DRIVERS.

DETECTIVES employed by the Taxi Service Company of New York recently discovered that drivers and starters were in collusion to defraud the company of a large part of vehicle earnings. In one instance it was proved that the driver of a machine which earned $31 only turned in $4 to his employers. The manager of the company says the losses for some time past, due to the dishonesty of drivers, has amounted to almost $500 a day.

The sum of $4,385 has been appropriated by the Richmond, Va., council for the purchase of a motor ambulance.

MOTOR CABS IN LONDON.

WEEKLY traffic returns are only supplied by one motor cab company in the world, the General company of London. This concern furnishes the following statement of vehicle earnings:

Week ending July 10	$98,707.20
Week ending July 17	89,558.40
Week ending July 24	91,944.00
Week ending July 31	87,883.20
Week ending August 7	65,606.40

On July 1 there were 3,394 motor cabs registered in London. On the same date there were 7,418 horse drawn cabs operating under license. In order to show how rapidly the latter are being retired by the introduction of the former the following table, which indicates the number of each class in use at three periods of the present year, is submitted:

Class of vehicle.	January 1.	April 1.	July 1.
Hansom cabs	4,826	4,354	4,039
Four-wheeled horse cabs	3,849	3,518	3,379
Motor cabs	2,805	3,094	3,394

During the past twelve months the number of motor cabs in London has more than doubled. The General company is the largest operator. It now has 1,700 machines in service. In a short time it will have 3,500. The second largest operating concern is the Coupe company, which has 1,500 machines in commission and will have 2,000 in a few months. Conservative opinion fixes the number of machines which will soon be required for London service at 5,000. A more liberal estimate puts it at 6,000.

The General company's business is now grown so great that it requires more working capital. Accordingly it is preparing to issue 5 per cent bonds for $2,000,000. The average number of cabs in use by this company during June, 1909, was 1,501, the average receipts per vehicle per day amounting to $9.

MOTOR CAB PROFITS IN NEW YORK.

DURING the past year the operations of the New York Taxicab Company showed a gross profit of $210,000. This sum would have been considerably larger had it not been for the costly and prolonged drivers' strike and the failure of Tracy & Company, the brokerage house which was so closely identified with the affairs of the cab company. Prior to the failure of the Tracy concern the cab company was notified that its money on deposit with the former establishment was not available to the latter, and when the suspension of the brokerage firm was finally announced it stood on the books of the cab company as a debtor to the extent of $85,000. During the past year the cab company has increased its equipment from 300 to 700 machines and has built a garage at a cost of $400,000. In the opinion of the foreign security holders the gross trading profit cannot be regarded as sufficient to meet depreciation and other charges.

The appropriation of $7,500 has been recommended for the purchase of motor fire vehicles in New Bedford, Mass.

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CIRCUS PROPRIETORS TO USE MACHINES.

RAILROAD transportation of circus equipment is so expensive and uncertain that the Robinson Brothers, who control or own the majority of touring circuses in this country, confess they will soon be compelled to use motor wagons, trucks and buses in making overland journeys.

The transportation of circus troupes, their impedimenta and animals, is not very highly prized by railroad traffic managers. Some companies even refuse to accept such business, the effect of which refusal is to cut the circus out of some of the best paying territory on the continent. The circus train is the object of such dislike in the railroad world that it is subjected to all sorts of delays, nearly every class of train traffic being given the right of way over it. Frequently the circus is late in getting settled in its temporary quarters solely because the railroad officials sidetrack its train while merchandise or cattle train traffic is being expedited. But what makes the circus magnate see red is the high and constantly advancing price he is required to pay for such inadequate service.

Railroad travel would have been abandoned by circus people this year, it seems, had Mrs. Bailey, who has managed the Barnum & Bailey show since the death of her husband, approved of the plans of the Robinsons; but she has agreed that the motor wagon shall be adopted next year.

BLUE SKY FREIGHTING.

MAKE way for the International Aerial Navigation Company, of Galveston, Tex., formed with capital stock of $1,000,000 "to establish airship service for freight and passengers to all parts of the United States, Mexico and other countries."

Machines to carry 12 passengers will be used, according to the prospectus. They will be built in St. Louis. Operations are scheduled to begin on January 1. The president of the enterprise is Dr. F. J. Field. The treasurer is Dr. Fred Terrell.

ANOTHER CAB COMPANY IN ST. LOUIS.

THE Columbia Taxicab Company has been formed, with capital stock of $200,000, to transact business in St. Louis. By October 1, the company expects to have its garage erected and 40 machines in operation. The St. Louis Taxicab Company has had a monopoly of traffic so far with its 60 machines. The new company is closely tied to the Buffalo firm from which it will obtain its equipment.

TRACKLESS TROLLEY COMPANY FORMED.

THE Trackless Trolley Company of New York has been formed with capital of $150,000. Counsel for the company says that American rights in a German transportation system have been secured.

Four armored cars will be employed in the forthcoming military maneuvers in Germany.

OFFSETTING ENGINE CYLINDERS.

THE ordinary way of placing engine cylinders with relation to the crankshaft, says Coker F. Clarkson of the A. L. A. M., is medially over, or opposite, the axis of the crankshaft. But for years some machines have been built with the center line of the cylinder or cylinders to one side of the axis of the crankshaft. This difference in practice raises a very interesting and much discussed subject.

It has been said that inasmuch as a gasoline motor crankshaft revolves in only one direction, it is mere common sense to place the cylinders in such a position that the pistons will transmit the power impulses to the crankshaft most effectively, that is, offset so that the maximum force of explosion is delivered on the piston when the crank is past the top vertical center line and therefore in the best position to receive it, and the pressure on the cylinder wall during fifteen to thirty degrees of the firing stroke is, owing to the reduction of side-thrust, diminished. While this statement may be true, it is apt to be misleading, and in any event is not the only consideration. There are very positive advocates both for and against offset cylinders.

Among the advantages claimed for offsetting are: shorter connecting-rods, reduced wear, lighter construction, reduced friction between the pistons and cylinders on the power stroke, more direct turning effect on the crankshaft, less likelihood of a knocking motor, less shock on the engine bearings, less overall motor height, greater motor flexibility, and appreciable increase in power.

On the other hand, it is said by those who prefer the construction wherein the cylinders are placed medially opposite the crankshaft, that the claimed advantages of reduced side-thrust on the power stroke and more direct turning effect on the crankshaft, have not much more than a theoretical value; that in t-head motors, with their two camshafts, offset cylinders involve complication desirable to avoid; that knocks are more common, and wear is greater, than in the usual type of engine. Further, it is said that the offset becomes less advantageous at high engine speeds. Perhaps the argument most commonly advanced against offset cylinders is that the engine is thrown out of balance when they are used.

The controversy comes down to two general positions. On the one hand: that in properly proportioned design it is unnecessary to offset cylinders in order to take care of the alleged counterbalancing advantage of doing so; and, on the other hand, that if an engine with offset cylinders is made as it should be, certain distinct advantages, which have been suggested above, are gained and clearly counterbalance any consequent disadvantages there may be.

In Washington, D. C., no charge is made by motor cab companies for sending machines within a radius of two miles from the place of call.

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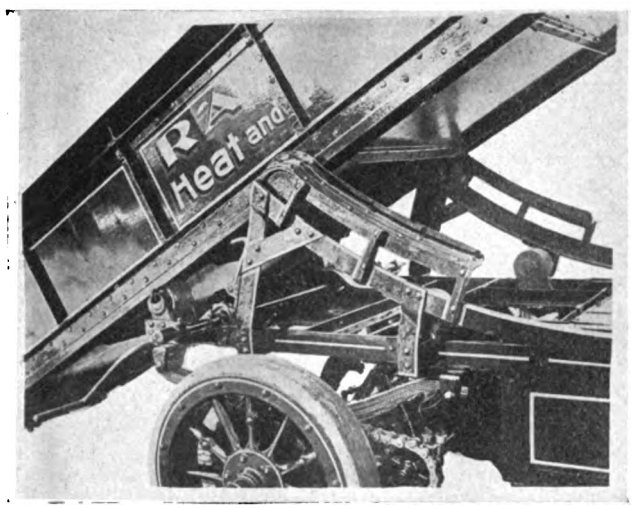
COAL DUMPING WAGON.

ANY mechanical device which facilitates the discharge of a motor wagon's cargo is necessarily interesting to those who have a transportation service where the use of such mechanism is indicated. The electric coal wagon employed by the Rainer Heat and Power Company, of Seattle, Wash., is equipped with a tipping body, the operating gear of which is worked by hand. With very slight additional expense the device might have been designed for operation by the power plant of the machine, a practice which undoubtedly will be commoner by and by than it is today.

This machine, a Studebaker product, is rated at 3½ tons and has been in service about four months. During



that period it has been carrying daily loads of 30 tons of coal and ashes from the company's plant. The daily mileage is not high, about 15, but the streets over which the machine travels are exceedingly rough, occasionally causing the breakage of the fragile battery lids and the spilling of the battery liquid. The expense of repairing this damage, however, is very slight. Touching the service efficiency of the machine, the manager of the company says it has been in operation about 87 out of 90 possible working days, which, considering the rough surfaces over which it has to operate, is a surprisingly good record. The current required for charging is generated on the company's premises, and is therefore furnished at very low cost. The machine is under the direct supervision of the company's electrician.

POLICE MACHINE ECONOMY.

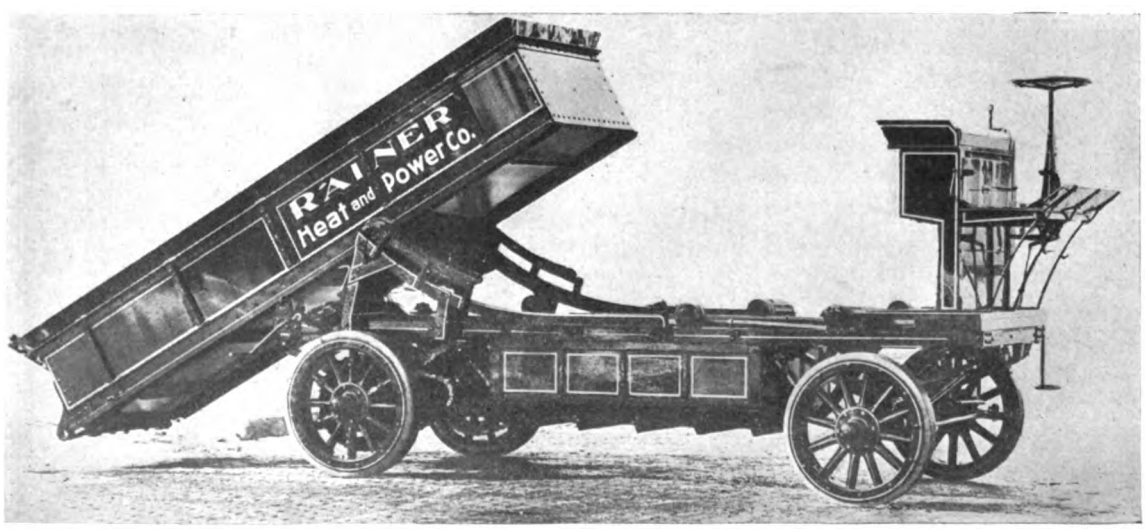
BASING his opinion upon the known fact that one motor patrol wagon will accomplish the work of three horses, the Louisville chief of police declares that a saving of $300 a year is to be obtained from every machine put in service. This is a very conservative estimate. Nor does it truly represent the full measure of the economy of the motor police wagon, seeing that the machine renders service which horses are incapable of performing. This latter advantage, which is of much more importance than the cash saving, was nicely shown in an article appearing in the last issue of this journal.

The North Manchester, Conn., fire department desires an appropriation of $2,500 as part payment for a motor hose and chemical wagon. The cost of the machine is to be $4,000, of which $1,500 has already been pledged by private parties.

The Trenton, N. J., Taxicab Company has been formed, with capital stock of $5,000.

Motor buses are operating between Uxbridge and Manchaug, Mass.

Germany can mobilize 106 military motor road trains, each consisting of a tractor and one or more trailers. Eight of these are the property of the government, the remainder being privately owned, but subject to conscription under the subvention act. This year Germany is spending about $675,000 in furtherance of her military automobile subvention scheme, $200,000 more than in 1908.



Hand Operated Tipping Gear Fitted to Coal Truck.

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Storage Battery Development

Brief history of the work required to make the electric vehicle the useful instrument it is to-day.

THE development of any art is largely a matter of time and experience, but in the case of the storage battery this is particularly true. As is generally known, the first type of storage battery plate was that of Planté, designed in 1860, in which the active material was formed from the metal of the body of the plate itself by a long series of charges and reversals. This process was so tedious and expensive, and the early forms of plate so crude, that the battery had only a very limited application; and when Faure in 1880 brought out his improvement, consisting of the mechanical application of lead oxides in the form of paste to the lead blanks, it was hailed as a wonderful advance. Companies were formed and batteries turned out in large quantities, these pioneers not realizing the perplexing problems of manufacture and operation which were soon to arise.

This premature exploitation of batteries unsuited to the conditions under which they were used resulted in a prejudice against all storage batteries which took years of patient work, development and demonstration to undo. The lamentable failure of the early forms of pasted or Faure types resulted in a return to the Planté form, and many radical improvements in construction and manufacture soon brought this type into favor for the positive plate, while for the negative an improved form of the pasted type was found to be best.

It should be understood that all that has been said so far, applies to the period before the introduction of the electric automobile. By the time experiments upon electrically propelled vehicles began to show promise, about 1895, the storage battery was firmly established as an important and necessary factor in the stationary field. Therefore the natural thing to do was to apply to vehicles the types which had proved the best for other uses. It was soon found, however, that if the vehicles were to have a practical radius of action, it was necessary to develop a lighter battery, and attention was turned again to the pasted type of battery plate.

As often happens in such a case, the pendulum swung too far the other way, and the first pasted plates made for the purpose were altogether too light and frail to withstand the vibration and heavy work to which they were subjected. Their capacity for weight was very high, and one of the earliest batteries put out, in 1899, drove an electric automobile over a hundred miles on one charge, even with the handicap of the cumbersome and inefficient vehicle of that time.

At the present time, with all the increased knowledge and the improvements in construction of both vehicles and batteries, it would be a simple matter to make a battery which should give a much higher mileage. But experience has proved that too high a capacity is obtained only at the sacrifice of life—you cannot "have your cake and eat it, too." This is something many inventors do not realize, their sole aim being maximum capacity.

The Electric Storage Battery Company went through all this years ago, and in the light of its experience developed as the most practical compromise for ordinary service—moderate capacity and long life—the present "Exide" plate.

Some owners of electric vehicles require a greater mileage per charge of battery than is normally obtainable from the "Exide" battery. To meet this condition, The Electric Storage Battery Company put on the market in 1907 its "Hycap-Exide" battery. The design of this type and its essential details are the same as the "Exide," but the plates are thinner, and a larger number can be used in the same space and for about the same weight, thus giving a greater capacity for a given weight and space, although the capacity per plate is less.

In a service calling for full mileage on each charge, the total mileage obtained during the life of the one battery is about the same as that obtainable from the other. The "Hycap" is for service in which the mileage required per charge is in excess of that which can be obtained from the "Exide."

The "Exide" grid is a modification of an earlier form, and its principal feature consists in having the active material held in the form of a pencil or ribbon between the horizontal ribs, which are staggered so as to firmly lock the material in place. The vertical ribs extend through from one face to the other, making the plate rigid, a property which is further secured by making the grid of a stiff lead alloy instead of pure lead. The construction of the grid, which is the same for the positive and negative except in total thickness and size of ribs, can be more clearly understood from Fig. 1, which represents a section through the cross-bars, showing their staggered relation.

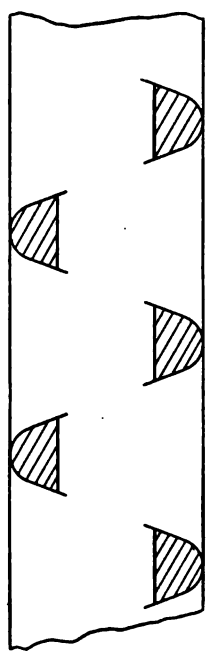

Fig. 1—Plate Section.

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Fig 2—Positive Plate.

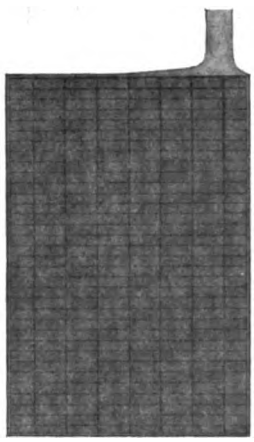

Fig. 3—Negative Plate.

Fig. 4—Wood and Rubber Separators.

These grids are "pasted" with lead oxides made into a paste of special composition which sets hard in drying, like cement. The plates then go through an electro-chemical process which converts the material of the positives into brown peroxide of lead, and that of the negatives into gray, spongy lead. Fig. 2 shows the finished positive plate, and Fig. 3, the negative.

In assembling the plates it was soon found that methods of separation which were satisfactory for other uses would not do for vehicle cells. In order to economize space it was necessary to have the plates so close together that any perforated separator would permit the material to bridge across from one plate to another, thus causing short circuits. This presented a new problem, and, after much experimenting, in 1901 the wood separator was developed. So important was this improvement that it is a question whether the vehicle cell could have become commercially successful without it. But certain substances contained in the wood proved to be insidious poison to the cells, and only after chemical treatment to remove these was it found possible to use it without great danger. The manufacturers developed a process which removes all deleterious substances without affecting the mechanical strength of the wood. The wood separators are grooved on the side which goes against the positive plate, to allow for circulation of the electrolyte and the escape of the gas generated when charging. To prevent the highly oxidized positive plate from charring the wood, and also to lessen the washing away of the positive material due to the vibration and the gassing on charge, a thin sheet of perforated hard rubber is placed between the positive plate and the wood separator. The two separators are shown in Fig. 4.

Both the positive and negative plates, as shown in Fig. 2 and 3, are provided with an extension or "lug," and they are so assembled that all the positive lugs come at one side of the jar, and all the negatives at the other, thus enabling each set to be "burned" together with a connecting "strap," giving one negative and one positive pole. The burning is done by a hydrogen flame which melts the metal of both lugs and strap into an integral union. The straps are made of lead or lead alloy, and are provided with rectangular openings arranged to register with the plate lugs when the plates are assembled and properly spaced.

There are two principal types of straps, which differ in the provision for cell-to-cell connections. The pillar strap is shown in Fig. 5. In this case the cells are joined by connectors, Fig. 6, which fit over the pillars of two adjoining cells, and are burned in place. The apron extending from the lower side of the strap is to keep the wood separators in place. The pillar straps are "low burned," being burned to the plate lugs below the top of the jar, with the cover resting upon them. Fig. 7 shows the "top" straps. These are "high burned," being above the top of the jar, with the plate lugs from two adjoining cells burned into the same strap. There are two forms of top straps, their use depending on whether the connection is to be side-to-side, or end-to-end, the former taking a "straight," the latter a "plate" strap. When covers are used with this type they are slotted to

Fig. 5—Pillar Strap.

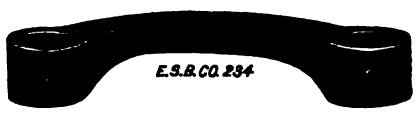

Fig. 6—Pillar Strap Connection.

Fig. 7—Straight Strap.

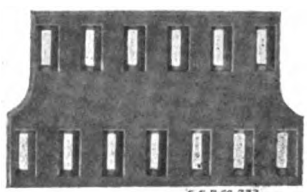

Fig. 8—Plate Strap.

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fit the plate lugs, and rest on auxiliary supports placed on top of the plates.

Fig. 8 shows a complete cell assembled with pillar straps, the jar being cut away to show the construction more clearly, and Fig. 9 shows a cell with top straps. The pillar strap is almost exclusively used in pleasure vehicles and light commercial work, while for heavy commercial vehicles the top strap is generally used.

The jars are of hard rubber, and are provided with ribs in the bottom to support the plates. Fig. 8 shows this. When pillar straps are used the cover is sealed in place with a special acid proof compound, so as to prevent splashing or spilling of the electrolyte, and a vent is provided for the escape of gas generated during charging. The vent plug is removable, leaving an opening for inspection, adding water to replace evaporation, and for testing the specific gravity of the electrolyte.

The cell units, burned together in number and arrangement to suit the vehicles they are designed for, are assembled in trays, (Fig. 10) of hard wood, painted with acid-resisting paint, and provided with suitable handles and terminals. The bottoms of the trays are provided with slits or holes for drainage in case of leaking or splashing of the electrolyte.

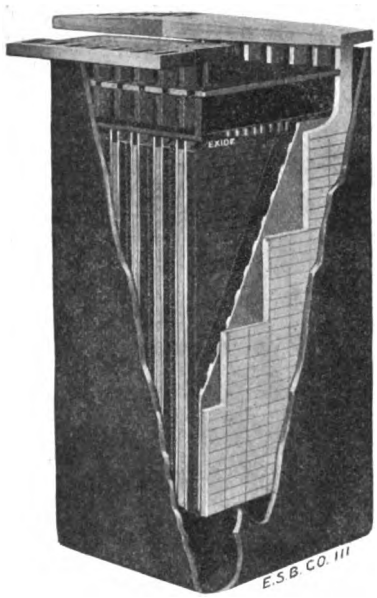

Fig. 9—Cell Assembled With Top Straps.

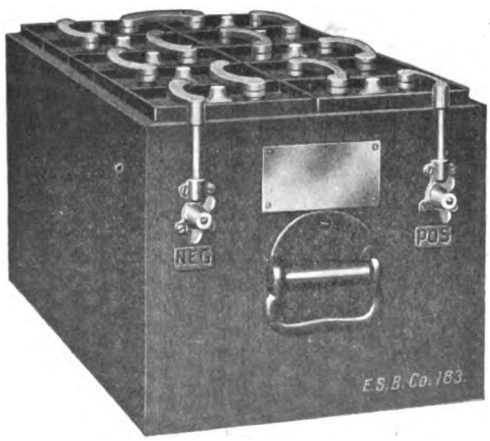

Fig. 10—Cells in Tray.

From time to time the papers tell in startling headlines of some wonderful new battery which is going to revolutionize the electric vehicle industry. Those who have seen and tested many of these products of sanguine inventors, know what value to place upon such announcements. The Electric Storage Battery Company is constantly testing batteries submitted by inventors, and it is a fact that nearly all of the batteries thus exploited have been previously tested by this company.

A consideration of some of the factors entering into battery manufacture will make it clear how impossible it is for a company lacking experience and facilities to turn out a uniform and satisfactory product. In the first place, purity and uniformity of materials are absolutely essential. Every run of lead or alloy, every keg of lead oxide and every lot of electrolyte used must be put through rigorous chemical and physical tests by experts in thoroughly equipped laboratories.

The casting of the grids, with their fine ribs, is an operation requiring much skill. Not only must the composition of the metal be just right, but the temperature must be carefully adjusted, and even with all conditions right, there are little "kinks" which only men of long experience can handle so as to get perfect castings.

The composition of the "paste" applied to the grids is the result of years of experimenting. All constituents must be carefully analyzed, and the mixing carried out and supervised by men who have had years of experience. Equally important is the process of "pasting," and here also the necessity of having experienced workmen and supervision is paramount.

The pasted plates, after several treatments, go to the "forming" room, where they are put through the electrochemical process referred to before. This perfected process, with all its details, is also the result of much experimenting, and requires skillful manipulation.

After "forming," the plates go through several further operations of washing, drying and other treatments, and are then ready to be tested. A large number of samples of each day's run go to a laboratory maintained for the purpose. Here they go through a practical test, being mounted into regular cells. If the samples pass the test, every individual plate is inspected before being delivered.

From June 10 to July 25 the Minneapolis motor police wagon traveled 1,197 miles, equalling the service of three teams of horses.

Within the past month six suits for injuries sustained while riding in motor cabs have been filed. One is for the recovery of $10,000 damages, the remainder being for $5,000.

A motor ambulance has been presented to the executive committee of Nassau Hospital in Mineola, L. I.

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MOTOR CAB OWNERS TO FIGHT.

IT IS understood that the majority of the motor cab companies operating in New York will fight the legalized reduction of the rate from 50 to 30 cents for the first half mile. The new rate is effective September 1. The increase in the cost of rubber tires and gasoline is urged as a reason why fares should not be lowered. The former, it is said, will cost $198 a set hereafter. Now they cost $150 a set. A set lasts about four months on an actively worked machine. Fuel, now selling at 10 cents a gallon, will, it is expected, soon cost 11 cents.

The sworn statement of the New York Transportation Company, presented to the mayor when the hearing on the ordinance was being held, showed that the average run of 146 machines owned by this company, from January to May, inclusive, was 37 miles, of which 22 were paid for and 15 non-productive.

The average earnings of each of these cabs at the old rate, 50 cents for the first half mile and 10 cents for each subsequent quarter mile, was 34.8 cents a mile; the average cost of operating was 33 cents, leaving a net income per cab per mile of 1.8 cents.

About $6,000,000 is invested in motor cab enterprises in New York; at least that is the par value of the stock of the operating companies.

An emergency police machine has been purchased for use in Brockton, Mass.

Next spring the Danville, Ill., fire department will be equipped with motor driven apparatus.

Motor bus service is to be established between Hickman, Cayce and Fulton, Ky.

Fire in the Kansas City Taxicab Company's garage recently caused a loss of $3,150.

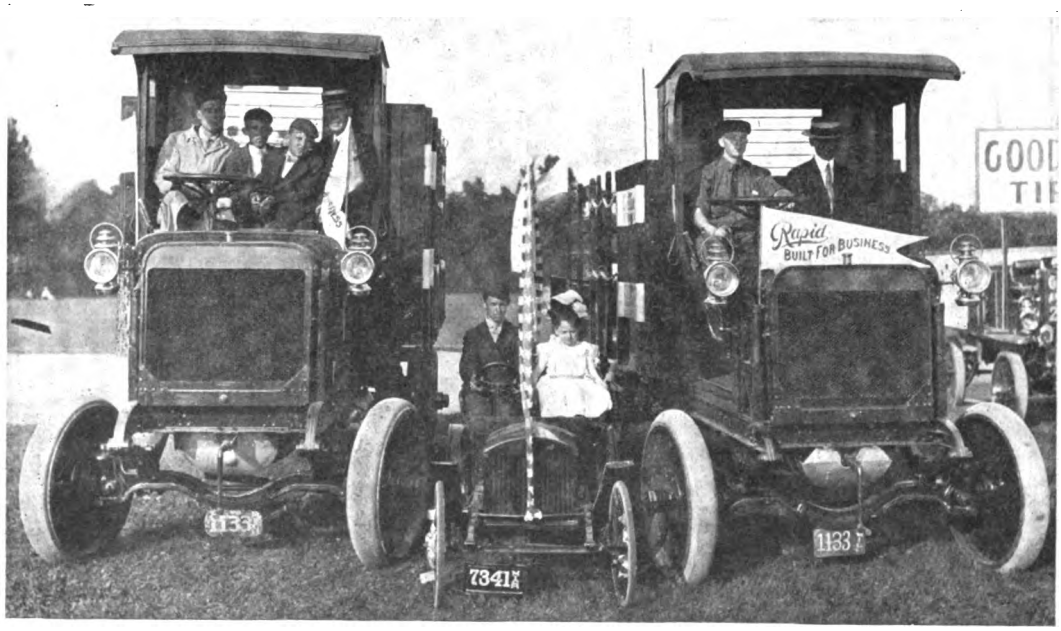
MIXED TIRE TREAD.

RUBBER and wood compose the tread of the wheel shown in the accompanying illustration, many of which are in use abroad for heavy truck duty. Three channel steel rims are shrunk on to the wooden felloe, and in these rims are placed blocks of rubber and of hard wood, the grain in the latter case being end ways. The outer circumference of the channels is bent into some extent in order to grip the blocks of the compound tread.

The wheel itself is constructed to give great resilience. In each of the channels blocks of wood and rubber alternate with one another, and when the wheel is new the wooden blocks stand somewhat proud of the rubber. The manufacturers assert that this tread will not slip on frosty surfaces.

ANOTHER MICHIGAN PRODUCER.

THE Utility Motor Car Company is the title of a concern recently organized in Ludington, Mich. It was brought into existence through the efforts of A. H. Hopkins and Walter Knight, who are its chief officers.



Largest and Smallest Machines in Detroit Parade.

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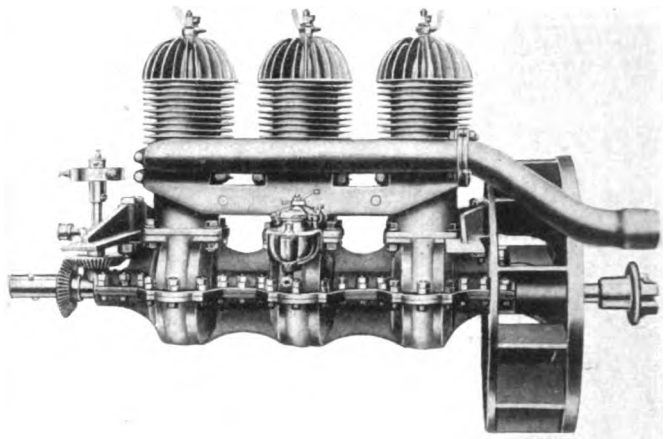
SIMPLE AND EFFICIENT WAGONS.

SUPERFLUITY of design is a defect of a great many gasoline wagons. This may not materially affect their economy in service, but it undoubtedly exercises a harmful influence upon a developing industry which in the present hour needs all the advantage it is possible to secure from simple engineering. The high first cost of the machine, which alarms so many prospective buyers, might be very conveniently lowered if more attention was given to simplification of design.

The models of the Chase Motor Truck Company, of Syracuse, escape this criticism. Their engineering is expressed in exceedingly simple form. For example, the motor contains only such parts as actually produce power. It is of the air cooled two cycle type. The action of the fly wheel fan, of the turbine suction type by the way, exhausts the air from about the engine and causes a strong draft through the openings in the hood directly on each cylinder. This fan is very powerful. The lubrication of the motor furnishes further evidence of the simplicity of design. It is accomplished without a single moving part. One quart of heavy gas engine oil is mixed with each five gallons of gasoline before straining into the gasoline tank. The mixture passes through the carburetor to the spray plug exactly as pure gasoline would, the oil having no effect on the operation of the carburetor. The current of air sweeping by the spray plug vaporizes the gasoline, leaving the oil suspended in the gasoline vapor in the form of a fine mist. This travels rapidly through the intake pipe to the engine. Every exposed surface is covered with a film of oil, which is the ideal condition for perfect lubrication. The quantity of oil varies with the amount of gasoline used, so that when the engine is working hard it is getting more oil than when working under a light load. This feature is not found in any other oiling system. As long as the engine is running it must get oil, and nothing can interrupt the lubrication unless the flow of gasoline is shut off, which would stop the motor.

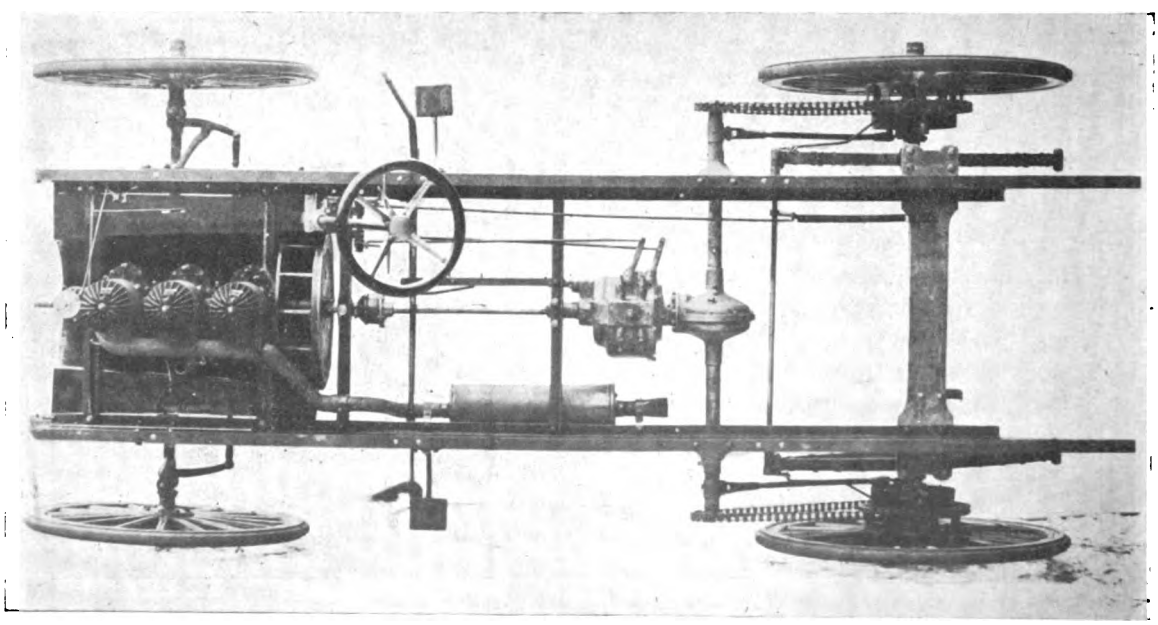
Other features of design are full elliptic springs and 40 inch rear wheels. The 500 pound delivery wagon is equipped with a two-cylinder engine developing 10 hp. The 1,000 pound wagon is fitted with a three-cylinder engine developing 15 hp. Both models are equipped with planetary transmission, double chain drive and jump spark ignition. Another model is designed for pleasure as well as business. It is convertible from a surrey, capable of carrying four passengers, to a light business wagon. This transformation is effected by adding or removing a rear surrey seat.



Chase three-cylinder, two-cycle, air-cooled, 15-hp. engine.

A MINNEAPOLIS ENTERPRISE.

MENTION was recently made of the formation of the Minneapolis Motor and Truck Company, capitalized at $500,000. The executives now announce their intention to erect a $100,000 factory for the construction of machines fitted with three cylinder two cycle engines. Models for agriculturalists will occupy a prominent place in the firm's product. The model of lowest rating will carry a ton, while the largest machine will be rated to transport six tons. The company proposes to make all its own parts.



Chassis of Chase Company's Model D equipped with three-cylinder, two-cycle, air-cooled, 15-hp. engine.

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CORRECTION OF ERROR.

IN correction of an article appearing in the last issue of this paper, wherein it was stated that the Pittsburg Motor Vehicle Company had been organized in Washington, D. C., for the manufacture of electric commercial vehicles, we publish the following communication from the Pittsburg Motor Vehicle Company, of Pittsburg:

To the Editor:—A competitor of the Pittsburg Motor Vehicle Company has circulated reports to the effect that said company has moved its business from Pittsburg to Washington. Such reports are not only untrue, but calculated to mislead both present and prospective customers. The Pittsburg Motor Vehicle Company takes this opportunity, therefore, of advising the trade that it is doing business as usual in Pittsburg, and intends to continue so doing. Steps have been taken to prevent further misrepresentation.

PITTSBURG MOTOR VEHICLE COMPANY.

NEW MODEL OF ODOMETER.

THE new model of the Veeder odometer is fitted with a new style twisted tooth gear. This style has many advantages over the old type of cut gear. It has a thin faced gear for cutting the mud and a wide face of tooth, which gives a greater wearing surface and allows for a side or end play. This makes close endwise adjustment unnecessary. The gear is made of steel, and with the hardest kind of wear will last indefinitely. The bearings are much improved over those in the 1909 model. This type is especially adapted for motor trucks.

MORGAN & WRIGHT BRANCH CHANGES.

MORGAN & WRIGHT will change their Atlanta branch location on September 1, settling at 50 North Pryor street. Herbert Starnes, who will succeed the Alexander-Seewald Company as local representative, is one of the tire company's oldest employes and has acted as its southern representative in the states of Kentucky, Tennessee, Missisippi and Alabama for several years past. On September 1 the company's Los Angeles branch will be moved from 118-122 East Tenth street to more commodious quarters at 1108 South Main street.

LONG WESTERN DEMONSTRATION.

ON August 4 the Grabowsky Power Wagon Company dispatched one of its machines from Detroit to the Pacific coast, a distance of about 3,000 miles. The vehicle will stop at all important points along the route and demonstrate its capacity and usefulness to merchants and others interested in motor road transport. More than ordinary interest attaches to the expedition by reason of the fact that so long a journey has never before been undertaken by a commercial motor vehicle.

Nine 30 hp. machines have been ordered for postal and military work in Servia.

Plans are being matured for the operation of a motor bus line between Sparta and Algood in Tennessee.

THE WESTINGHOUSE STORAGE BATTERY.

THE Westinghouse Storage Battery Company, which was incorporated July 12, has acquired all of the plant, patents and equipment of the storage battery department of the Westinghouse Machine Company and of the General Storage Battery Company, and will manufacture, at Boonton, N. J., both the Westinghouse and Bijur types of storage battery. The new company enters the field with greatly increased manufacturing facilities and the best engineering talent obtainable, and will maintain thoroughly equipped testing and commercial laboratories, insuring uniformity of both materials and product.

SWINEHART COMPANY'S NEW OFFICERS.

THE Swinehart Clincher Tire & Rubber Company announces the following officers elected at the stockholders meeting held August 23: President, J. A. Swinehart; vice-president and general manager, W. W. Wuchter; secretary, C. O. Baughman; treasurer, R. A. May. President Swinehart will devote his time to the company's European interests, sailing about October 1. Mr. Wuchter, who has been general superintendent of the Firestone Tire & Rubber Company for the past five years, will assume the active management of the company's affairs. It is the company's intention to eventually embark in the manufacture of a pneumatic tire now being developed, and to carry on a more extensive selling campaign. The entire capital stock of the company has now been sold, and immediate steps will be taken to improve the equipment and enlarge the factory capacity. The company is now developing and thoroughly testing out an improvement in its solid commercial tire equipment.

TO MAKE MACHINES IN MUNCIE.

IT is expected that the Muncie Motor Truck Company will soon be organized at Muncie, Ind. To this end Thomas W. Warner and Hugh Warner of that city are co-operating with D. O. Skilton of Yorktown, Ind., and Milton E. Ailes, a banker in Washington, D. C. Mr. Ailes was formerly assistant secretary of the treasury.

FRANKLIN COMPANY SPLITS MANUFACTURE.

HEREAFTER the H. H. Franklin Mfg. Co. will make commercial motor vehicles in a building separate from that in which its other automobile product is made. In the past the building of commercial machines has been a part of the general work of the factory. Specialization is now demanded, and the new department will be put in charge of Herbert Hess as manager and W. F. Kneip as engineer.

MEISELBACH TO RESUME MANUFACTURE.

ARTICLES of incorporation have been filed by the Meiselbach Mfg. Co., of Milwaukee. The concern will build commercial motor vehicles for all purposes. The capital stock of the company is $50,000. A. D. Meiselbach, S. Wallheim and L. W. Clough are the principal stockholders.

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Wagon Maintenance

Tips to new drivers and caretakers about things which are likely to escape their attention.

ONE of the best and simplest devices for removing carbon deposit from engine cylinders is a common housekeeper's metallic wash rag, made of a series of wire rings interlocking with one another. The kind preferred is that in which the rings are composed of two coils of wire, one coil overlapping the joint. Another kind, not so good, is that which has no wire overlapping the joint and can, with little effort, be pulled apart. One of these metallic articles dropped into a cylinder and the other cylinders made to run about ten minutes completely removes the carbon.

* * *

Removing Corroded Nuts from Battery Terminals.

The nuts of storage battery terminals, unless they are of non-corrosive lead type, often become rusty and hard to remove, and a great many battery elements have been spoiled by breaking of the terminals in trying to unscrew the rusty nuts. The removal of such nuts may be readily accomplished by first heating them with a pair of pincers, the jaws of which have been raised to a red heat and then applied to the nut. The application of heat has both a dissolving action on the salts forming the rust and an expanding action on the nut. A little kerosene applied to the thread before an attempt is made to remove the nut also facilitates removal.

* * *

Causes for Rattling Hoods.

Despite the maker's precautions motor hoods persist in rattling. In cases where the hood seat, on ledges formed on radiator and dash, has been lined with felt or with belt lacing, no apparent reason for the sound can be discovered. In such instances a worn spot in the sound-deadening pad, or a point in the metal which has been dented badly, usually will be found. In no case is the nuisance an excusable one.

* * *

Care of the Engine.

Do not run on less than all the cylinders. If a cylinder is not working try to apply a remedy at once. Do not allow the engine to race. This is a most pernicious practice. Always run with the spark advanced as far as possible, and control the car by the throttle rather than by the spark. If you are compelled to run the motor very slowly, retard the spark and close the throttle as much as possible. Do not, however, make a practice of running with retarded spark and open throttle. Always throttle down the engine in throwing out the clutch or when the motor car is standing with the engine running. Overheating is due to two things—friction, caused by lack of oil, and running the engine on a retarded spark and an open throttle. The latter is less harmful, but it is possible by advancing the spark, partly closing the throttle and going into the lower gear to cool off the engine without stopping the automobile. When overheated, the engine pounds or knocks and shows a loss of power at low speed or on hills. Overheating will be avoided if the engine is properly oiled and is not run on a retarded spark and an open throttle.

* * *

Cleaning the Brake Linings.

Many a driver who has complained that the brake linings of his car wear out quickly could prolong the usefulness of these linings by flushing out the brakes when he comes home from a run through mud. It is impossible to keep grit from accumulating between the braking surfaces, and a little water used now and then will do much toward affording serviceable brakes all the year round.

* * *

Oil Seepage Should Be Investigated.

Sudden tendency to oil seepage through the parting line of the crank or gear case should be followed by an immediate investigation. While it may be due merely to the loosening of some of the fastening bolts, there also is a possibility that some unusual strain has so wrenched the shafts and bearings as to spring or even crack the housing. If such happens to be the case, of course, the internal mechanism also must be attended to at once.

* * *

Use Judgment in Operating Brakes.

See that the brakes work evenly and easily. Never jam them on too suddenly. Instant locking of the brakes not only destroys tires, but is likely to injure the vehicle itself. A motor wagon can be stopped in the shortest distance by putting the brakes on gradually and firmly.

* * *

The city hospital authorities of Newark, N. J., are campaigning for another motor ambulance. The one now in service cost $2,300.

The Paterson, N. J., Auto Express Company has been organized with capital stock of $100,000.

The Auto Transfer Company of Raleigh, N. C., has been organized, with capital stock of $100,000.

The "Exide" Battery is used in over 90% of all Electric Vehicles made.
Ask us for attractive renewal proposition.
BUY WHAT THE EXPERTS BUY.
THE ELECTRIC STORAGE BATTERY CO. 1888 1909
NEW YORK BOSTON CHICAGO ST. LOUIS PHILADELPHIA, PA. CLEVELAND ATLANTA SAN FRANCISCO TORONTO

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The Power Wagon

A Journal for Those Employing Commercial Motor Vehicles

No. 59 **OCTOBER, 1909** **No. 59**

PUBLISHED THE FIRST OF EVERY MONTH BY

THE POWER WAGON PUBLISHING CO.

SUBSCRIPTION RATES:

One Year (Domestic)	$2.00
One Year (Foreign)	3.00
Single Copies	.20

PUBLICATION OFFICES:
THE METROPOLITAN BLOCK
Chicago, Illinois.

Advertising Rates on Application

WALTER WARDROP, Editor

Entered as Second-Class Matter December 2, 1907, at the Postoffice at Chicago, Ill., Under the Act of Congress on March 3, 1879.

Leased Machine Service

Terms upon which New York firms may obtain electric machines of all ratings.

LEASING or contracting for the service of motor wagons at a fixed weekly, monthly or yearly rental is now so common as to deserve close attention.

Within the past year quite a number of companies have been formed for the supply of such service. The active manner in which their equipment is operated must be regarded as reliable evidence of the need which exists for such undertakings. The price at which the work of the machines is sold, together with the skill shown in administering them, make it practically certain that the operators are realizing good profits upon their investments.

Both electric and gasoline machines are employed, though not in mixed installations. The customers of the operating companies are in all cases concerns which admire the superior utility of motor wagons, but for one reason or another hesitate to buy them. This hesitancy is turned to good account by men of courage and ability. Mechanical road transport has no terrors for those who are familiar with its practice. Its advantages are only doubted by those who lack capacity for intelligently comparing it with horse transportation. Even these are willing to be convinced of its superiority, but their ignorance of mechanical matters, and reluctance to let go of established haulage practices, make their persuasion very difficult.

* * *

In such a situation the appearance of the professional motor wagon operator is very welcome. He is something more than an opportunist. Operating extensively, he demonstrates the value of the machine in all classes of service, and if he profits thereby he gains no more than his perspicacity deserves. Naturally he has the enthusiastic support of the manufacturer whose product he puts into commission. Aid, administrative and otherwise, which is only extended to large buyers of equipment, is freely put at his disposal, and he is at all times fortified with such valuable counsel as experience alone can offer. Compare his condition as a factor in transportation with that of a large business house which installs one or two machines in a stable full of horses, and then, in the belief it has discharged its full duty to the investment, abruptly terminates its intimacy with the sellers and disdainfully rejects all suggestions for improvement of the service.

* * *

In New York City there are two concerns which lease the service of electric machines of various ratings. The Motor Delivery Company, which employs 14 electrics in mail collection service, rents wagons and trucks made by the General Vehicle Company on yearly contract to merchants at the following rates:

Machine capacity.	Daily Service Charge.
1,000 pounds	$10.00
2,000 pounds	11.00
4,000 pounds	12.00
7,000 pounds	13.50
10,000 pounds	15.00

The foregoing charges include the wages of drivers. The bodies of these leased vehicles are painted and lettered to suit the wishes of the establishments in whose service they are operating. They also bear the titles of the firms whose merchandise they convey. The Motor Delivery Company assumes responsibility for the care and upkeep of the machines, which are garaged in the building of the New York Transportation Company on East Twenty-fifth street. Each machine is worked for nine hours daily.

This company has a four-year contract to supply the post office in New York with the service of electric machines at 22½ cents per mile. In this service it employes eight 1,300-pound machines, four with 2,500 capacity, and two of 4,500-pound rating. Only eleven machines, however, are kept in daily service, two being held in reserve. Each service machine averages 52½ miles daily in actual service, plus a slight dead mileage. To

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accomplish this it is necessary to give each vehicle battery a short "boost."

In addition to this service the company also transports second class mail matter from publishing houses to railroad terminals, using its 7,000-pound electric machines in this service by permission of the post office department.

* * *

Leased electric vehicles may also be had from the H. C. & A. I. Piercy Company of New York. This old established package carrying company recently installed a considerable number of Studebaker machines. Its business is conducted in a manner quite similar to that just described, customers to all intents and purposes owning the vehicles bearing their names, but in reality paying rental for their service in order to escape the responsibilities of administration.

MACHINES FOR RAILROAD SERVICE.

WORD comes from Pittsburg that the Pennsylvania railroad is planning to use electric wagons and trucks in place of its horse-drawn vehicles. There is some talk of building the machines in the telegraph department of the Altoona shops, but it is likely that the order for their construction will be given to a motor truck manufacturer whose knowledge of design and mechanical road haulage will be a guarantee that the vehicles will fulfill all the requirements of service.

ARMY COMMISSARY MOTORS.

WELL-INFORMED army officers state that the war department is about to concentrate its attention upon the military motor wagon. They say that the work of the machines used during the recent "war game," was so striking, especially in commissary service, as to force recognition of their usefulness in times of peace as well as trouble. It is understood that for the present congress will not be solicited for aid in developing the application of the army motor wagon. The quartermaster general, however, has money which it is within his discretion to spend for the betterment of the service over which he exercises control.

Commissary General Sharpe is a strong believer in the use of the motor truck in the transportation of supplies. While transportation is a matter for the quartermaster general, still General Sharpe has given a great deal of thought to the subject by reason of the intimate relation existing between transportation and the feeding of troops. He points out that in the wars of the future the motor wagon is going to be indispensable, for the reason that there will be enormous forces to be fed and supplied, and they will stretch over a wide front.

Speaking of the vast problem of feeding a modern army, he likened it to feeding the population of a big city. He says it would be an easy problem if the population were not moving, but if the inhabitants were to move ahead ten or fifteen or twenty miles every day it would be a gigantic task to keep all supplied with food, not to mention other supplies. He thinks that the motor truck, which is capable of carrying heavy loads a long distance in quick time, is indispensable to the army.

PROPOSED FEDERATION OF INTERESTS.

NO industry which is without the protection that a well planned organization of its component parts affords has yet succeeded in warding off the attacks of its enemies or the evils of foolish legislation. It is idle to think that the commercial motor vehicle trade body or its dependents, the users of machines, can hope to drift along much longer lacking such a mainstay. In other countries the owners of machines are banded together for mutual benefit. They co-operate heartily with trade organizations which are vitally interested in extending and safe-guarding the sphere of the business motor vehicle's influence, and the work thus jointly accomplished has been of great value. Decisive and unanimous action upon a great many matters affecting mechanical road haulage is badly needed just now. There is also great need for fixing a standard of thought concerning its practice and principles.

An emergency having arisen in England over the proposal to tax the fuel of machines, a federation of all interested in motor road haulage has been proposed. The objects of this league are as follows:

1. To combine to resist repressive legislation promptly and effectively.

2. To bring pressure to bear in cases where town councils and other local authorities act in a tyrannical manner or are obviously interested in or prejudiced in favor of competitive methods of transport.

3. Where necessary to support the contentions of members on important legal points.

4. To allow a more free interchange of opinion between manufacturers and users, so that each would understand more clearly the position and requirements of the other.

5. To assist drivers, mechanics, etc., to obtain employment or better their position, and to give this class an opportunity of expressing their views on important matters, such as taxation, police requirements, etc.

6. In general, to be ready to organize promptly deputations or petitions to put the case for the industrial motor vehicle before government or official bodies who may be responsible for laws or restrictions likely to be detrimental to the industry.

The contemplation of such a project should, at the least, cause American makers and their customers to consider how little power they actually possess for accomplishing any of the great reforms of which they complacently dream. There can be no substantial progress in the industry until its various elements are knit together with a common purpose. Organization by classes, therefore, is a paramount duty. Federation will come later.

The Peekskill, N. Y., authorities have decided to purchase a motor vehicle for the fire department at a cost of $7,500.

The sum of $7,500 has been appropriated by the council of Wichita Falls, Tex., for the purchase of motor fire apparatus.

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Motors Reduce Fire Losses

One machine protects three times as much territory as a piece of horse drawn fire apparatus.

AT the recent meeting of international fire department chiefs a flood of light was shed upon the remarkable service which motor apparatus is everywhere rendering. Of all the testimony offered, however, perhaps none was more convincing than that submitted by John A. Glanville, chief of the salvage corps of St. Louis.

Before examining it let it be understood that the salvage corps represents the insurance companies at all fires, and on that account is presumed to be unusually keen for the avoidance of property losses. These useful auxiliaries were among the first to recognize the great importance of the speed element of motor fire apparatus, and many of them are provided with machines which are equipped with extinguishers and tarpaulins. It is their constant object to be first at the scene of a fire and if possible to quickly subdue or control the flames. Considering their mission, and its substantial value to property owners, it is but natural that they are enthusiastic supporters of the policy which favors the retirement of horses from fire department service.

* * *

Mr. Glanville's opinion of the value of motor fire apparatus rests upon a solid foundation. He has had extensive experience with it. He says:

"I believe you will all concede that quick action is the most essential feature in fighting a fire, for if all fires were discovered and reached in their inception the losses would be comparatively insignificant. Judging from my own experience during the past eighteen months, I figure that if the time were reduced in getting to a fire after the alarm is received, one-half of the losses would be reduced more than half. What I present for your consideration is not based on theory but facts, as I have learned by experience. One motor car will protect three times the territory that horse-drawn apparatus will, and do it very much better owing to the quick operation of the motor, which can make a run in less than half the time of the horse, and, I will add, much more safely; and if there is no occasion to hold an apparatus the return trip can be made just as quickly, the apparatus being ready to respond to other fires that may occur. The number of trips made in a day is of no consequence to the motor apparatus, whereas the horse must be considered; and, again, where there are two, three or a general alarm given for the same fire, or two or three fires occur in the same locality in close proximity, the last company to arrive will find the building destroyed.

* * *

"As to the cost of maintenance, I can only give my own experience. With the motor apparatus I am covering three times the territory covered with the horse-drawn apparatus, and, without increasing the force of men, doing more effective work. It required four horses to care for one-third of the territory at an annual cost of $816 for shoeing and feeding, against the total cost of the motor car for one year of $481.31 (including two accidents, and $250 of this amount was the result of the accidents).

"The reliability of the machine we have in use has been well established. During its eighteen months' service we have not had a failure to respond to fires, having responded to 1,050 fires and traveled 2,250 miles in so doing. We have had opportunity to test it under the most severe weather conditions, cold, sleet, snow and mud, to all of which the response was marvelous. For instance, one special call from a very fine country home beyond the city domain, the distance being nine miles from quarters, the run was made and the fire extinguished with a trifling loss, that might have destroyed the entire property which represented $60,000 to the owners.

"The life of the motor apparatus has not yet been determined. However, judging from the mileage and endurance of the pleasure motor, which does not get the care that a fire apparatus does, the fire apparatus would serve for twenty years with the ordinary repairs given the horse-driven apparatus."

THE INJURIOUS HORSE.

FOR the purpose of deciding whether motors or horses cause the greater injury to roads the following test has been proposed: Let a place be selected where there is considerable traffic of both kinds, and where it is possible to make a loop road some two or three hundred yards long, running parallel with an existing road. Let the roads on both sides of the loop be laid down in exactly the same manner, and then cause all the horse traffic to take one side of the loop and all the mechanical traffic the other side.

Both roads would then be inspected from time to time, and the effect of the traffic upon the surface noted. The result is certain, and would much surprise those who condemn motor traffic as being destructive to roads. After a few months, the arrangement should be reversed, and it would then be seen how the horse traffic had so injured the road that the motor traffic would complete the destruction, while the horse traffic being turned on to the side of the loop that had been used for motor traffic would soon pick into it with the hoofs, and crush into it with the narrow iron wheels.

It is sincerely to be hoped that such an experiment may be tried.

The Taxicab Company of Salt Lake, Utah, has been organized with capital stock of $25,000.

Motor cab service is to be provided in Mobile, Ala. Four machines will be operated at the outset of the undertaking.

Motor cabs will soon be placed on the streets of Jacksonville, Fla. Sixty drivers have been engaged.

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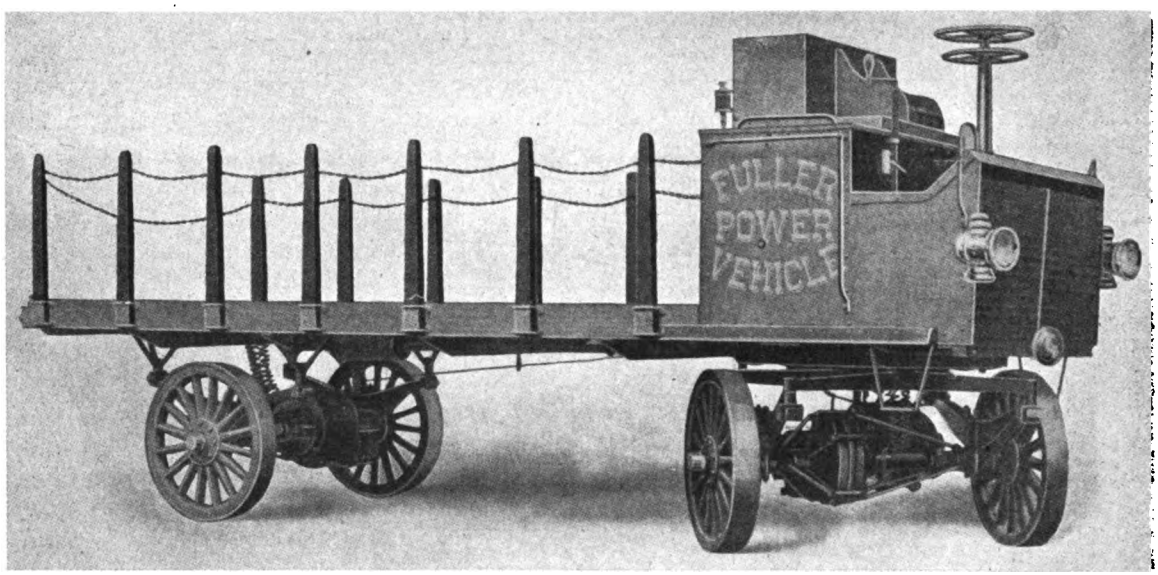

Seven-ton gasoline electric truck equipped with steel wheels. Maximum speed six miles per hour.

Gas-Electric Seven Ton Model

Description of machine equipped with steel tires and operated at six miles an hour.

GAS-ELECTRIC machine design is being developed with such rapidity as to greatly encourage the belief that it will soon become quite prominent. Within the past few months no less than four models of this type have been privately disclosed to view. Three others, like the one it is now proposed to consider, are ready for the market and will be described in later issues of this journal. Only one inference can be drawn from this activity, namely, that the engineering of the subject is much farther advanced than is generally suspected, and that the economy of the type is pretty well established.

* * *

The gas-electric vehicle made by the Fuller Power Truck Company, of Delphos, Ohio, is rated to carry seven tons, with a safety allowance of 50 per cent. The initial power is a gasoline engine direct attached to an electric generator providing ample power for the purpose for which it is designed. By a simple winding of the generator the starting torque of the vehicle is no more than the running torque. The secondary power consists of four motors, one for each wheel, of sufficient power to propel the vehicle over ordinarily good roads at a speed approximately of five miles an hour, when it is loaded to maximum capacity. These electric motors are securely mounted, two on each axle, with the driving power applied to the axles by a system of compound gearing enclosed in a dust and oil tight gear casing. They are always under the control of the operator, so that he can regulate the speed of the vehicle in either direction, forward or backward, from zero to full speed, or any intermediate degree, without making a change in the action of the initial power, as the engine operating the generator is practically automatic in its workings.

Four feet is taken up by the engine, generator, water tank, fuel tank, radiator, etc. The remainder, 16x6 feet, is loading platform. The body is composed entirely of steel.

The forward end of the vehicle is supported on a fifth wheel or turntable, having ball bearings of a size and strength capable of sustaining the heaviest loads under any conditions of ordinary service. On the lower half of this turntable is secured the steering sector, enabling the operator to move the forward axle with its driving power in either direction from a straight line to such a degree as to permit of the vehicle being turned practically in its own length. In this steering movement the forward electric motors only may be used, or both the forward and rear axle motors.

* * *

The springs are semi-elliptic, tested to sustain a load of 5,000 pounds per spring on a four-inch deflection. The axles are of a very high grade of steel, such as is used in the government mountain guns, hook and ladder trucks, fire engines, etc., a class of material especially made to withstand heavy jars and shocks. The main bearings of the axles are of what is known as navy bronze, a material specified by the navy department to be used in all classes of high speed engines and other machinery under heavy strains and shocks. These bearings have large surfaces facing the axle and are at all times thoroughly lubricated by what is known as capillary oiling, that is the box surrounding the bearing proper is packed with a wool waste saturated in oil. This practice of oiling journals is in general use by all railroads for the lubrication of journals under passenger coaches and the like. The wheels are of the artillery type, such as are used generally by the government on mountain guns, and are made by the same people who have been making such wheels for some forty years. The tires are of steel, three-quarters of an inch thick, and of a width to suit the conditions of service.

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All parts of the machine are very accessible, admitting of any repair without the use of a pit. Its weight, including fuel and water, is approximately 6,000 pounds, being without question the lightest vehicle for its carrying capacity at present manufactured. It has the further advantage of being driven by all four wheels, and so secures the traction of the three remaining wheels should one slip. The work being done by all four of the wheels relieves the truck of all strain.

FRENCH INDUSTRIAL MOTOR TRIALS.

FOR the industrial motor road vehicle trials to be held in France next month 57 entries have been secured. The trials will begin on October 15 and end on November 15. They will be conducted jointly by the war department and the Automobile Club of France, each of which bodies has promulgated regulations of its own. Only eight machines, however, will be tested by the military authorities. Seventeen will be tested under club rules. The remainder will operate under both regulations.

The makers of machines which are successful in the military test have the privilege of claiming a government subsidy amounting to $1,200 for four years. Purchasers of machines of the type which pass the military test can also claim this subsidy by agreeing with the government to present their vehicles for inspection once a year, and to sell such property at a prearranged price in case of war, $600 on purchase and $200 for each of the three following years.

There are three principal service divisions—wagons, omnibuses and road trains. The wagons are grouped in five classes, including machines with load capacity from 880 pounds to three tons and up. The road trains also are split into classes, tractors and trailers for freight, and tractors and trailers for mixed freight and passengers. There are three classes in the bus section, one for machines to carry from 6 to 10 passengers, another for machines to carry from 11 to 20 passengers, and a third for those carrying more than 20 passengers.

There will be two routes for the various machines, one 62 miles in length and the other 93 miles. All routes will end at Versailles, eight miles outside Paris. The territory in the neighborhood of Versailles provides all kinds of roadway, smooth and rough, hilly and level. The military vehicles will make several journeys in convoy at fixed speed, and with fixed distance between each unit in the column. Alcohol, gasoline and benzol are the fuels permitted. From October 18 to 31 gasoline will be used, from November 2 to 6 carburetted alcohol, and from November 8 to 15 benzol.

A warrant has been issued for the arrest of C. T. Byrnes, night dispatcher of the Seattle Taxicab Company, Seattle, Wash., on the charge of having stolen $285.

At a recent meeting of the Elwood City, Pa., council a committee was appointed to communicate with makers of motor fire vehicles.

MAINTENANCE CONTRACT COSTS.

HERE are the terms of a maintenance contract which is rather freely accepted in England by such concerns as hesitate to assume full responsibility for machines used in their business:

The maintenance company, which also produces the machines, inspects its customers' vehicles every week at its garage, and makes such replacements as may be necessary to keep them on the road.

It completely overhauls the vehicles at its works twice a year.

It gives a rebate whenever the maintenance proves to be less than calculated, returning 50 per cent of the profit over a certain sum.

Vehicle owners must maintain tires.

Vehicle owners employ drivers, who are subject to instruction from the maintenance company.

Vehicle owners must not operate their machines more than 500 miles a week, nor at a speed in excess of 15 miles an hour.

A charge of $390 a year is made for the maintenance of a 3 or 4 ton truck, $325 for a 2½ ton machine and $260 for a 3,000 pound machine. The weekly expense of operating the three types of machines which this firm makes are as follows:

Three to Four-ton Machine 500 Miles Per Week.

Tires at 4 cents a mile	$20.82
Gasoline (6 miles to gallon, 25 cents per gallon)	20.75
Drivers' wages	8.25
Lubricating oil	1.00
Grease	1.12
Repairs (cost of parts without labor)	3.75
Total	$55.69

Two-ton Machine 500 Miles Per Week.

Tires (2.5 cents per mile)	$13.04
Gasoline	13.04
Driver's wages	8.25
Lubricating oil	1.00
Grease	1.12
Repairs	3.50
Total	$39.95

3,000-Pound Machine 500 Miles Per Week.

Tires at 2 cents per mile	$10.43
Gasoline	10.43
Driver's wages	8.25
Lubricating oil	1.00
Grease	1.12
Repairs	2.50
Total	$33.73

Live fish are daily transported by motor wagon to Paris from breeding ponds sixty miles distant. Two machines are used for this purpose, the bodies being metal tanks filled with water which is agitated and aerated by the engine pump.

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Selden Patent Upheld

Text of decision rendered by U. S. Circuit Court--Appeal will likely be taken.

THE validity of the Selden patent has been upheld by the United States circuit court for the southern district of New York. It is extremely probable that the case will be taken to the court of appeals and, mayhap, finally to the supreme court. Whatever the outcome of the litigation may be it is unlikely that owners of unlicensed machines will suffer any loss.

Nominally the complainants in this historic case are the Electric Vehicle Company of Hartford, Conn. (now known as the Columbia Motor Car Company), and George B. Selden of Rochester, N. Y., original owner of the patent in dispute. The cause of the complainants is championed by the Association of Licensed Automobile Manufacturers, which body comprises all who recognize the validity of Selden's claim. The defendants are the Ford Motor Car Company of Detroit; the O. J. Gude Company of New York city, a purchaser and user of an unlicensed car; John Wanamaker, dealing in unlicensed cars; the Societe Anonyme des Anciens Etablissements, Panhard & Levassor, and Andre Massenat, makers and importers of unlicensed foreign cars; and Henry & A. C. Neubauer, importers.

The Selden patent, issued November 5, 1895, expires in 1912. Its recognition by part of the manufacturing body was followed by the formation of an organization which includes all who deny its validity. Numerically the latter are in the majority. The full text of the recent decision is as follows:

The application for the patent on which these actions are based was filed in 1879—or more than sixteen years before the grant was made.

The principal claim in suit (No. 1) reads thus:

"The combination with a road locomotive, provided with suitable running gear ,including a propelling wheel and steering mechanism, of a liquid hydrocarbon gas-engine of the compression type, comprising one or more power cylinders, a suitable liquid fuel receptacle, a power shaft connected with and arranged to run faster than the propelling wheel, an intermediate clutch or disconnecting device and a suitable carriage body adapted to the conveyance of persons or goods, substantially as described."

The second claim varies from the first only in requiring the "suitable carriage body" to be "located above the engine" while the fifth claim sets forth substantially the same combination, but specifically describes the engine as comprising a plurality of cylinders with "piston arranged to act in succession during the rotation of the power shaft."

These three claims are alleged to be infringed by all the defendants.

This statement of complainants' position seems sufficient to show that the subject matter of these suits is the modern gasoline automobile. The defendants are severally the manufacturer, seller and user of the Ford machine (a well-known American make), and the maker and importer of the Panhard, a celebrated and typical French product. If these defendants infringe, it is because complainants own a patent so fundamental and far reaching, as to cover every modern car driven by any form of petroleum vapor, and as yet commercially successful.

Such a claim lends interest even to such a record as is here submitted, and requires careful examination, to the end that the parade of forces in this court, may at least serve to shorten and simplify the certain conflict in the appellate tribunals. (Note.)

[Note: It is a duty not to let pass this opportunity of protesting against the methods of taking and printing testimony in Equity, current in this circuit (and probably others), excused if not justified by the rules of the Supreme Court, especially to be found in patent causes, and flagrantly exemplified in this litigation. As long as the bar prefers to adduce evidence by written deposition, rather than viva voce before an authoritative judicial officer, I fear that the antiquated rules will remain unchanged, and expensive prolixity remain the best known characteristic of Equity.

But reforms sometimes begin with the contemplation of horrible examples, and it is therefore noted, that the records in these cases, as printed, bound and submitted, comprise thirty-six large octavo volumes of which more than one-half contain only repeated matter, i. e., identical deposition with changed captions, and exhibits offered in more than one case. In reading the testimony of one side in one set of cases, there were counted over a hundred printed pages recording squabbles (not unaccompanied with apparent personal rancor) concerning adjournments—and after arriving at this number it seemed unnecessary to count further. In many parts of the record, there are not five consecutive pages of testimony to be found, without encountering objections stated at outrageous length,—which may serve to annoy and disconcert the witness, but are not of enough vitality to merit discussion in two thousand pages of briefs. Naturally tempers give way under such ill-arranged procedure, and this record contains language, uncalled for and unjustifiable, from the retort discourteous to the lie direct (e. g. Ford, C. R. pp. 2873, 2967-8, 2987-8). And all this lumbers up the Court record room, while clients pay for it.

Even when evidence in Equity was taken by written answers to carefully drawn interrogatories, the practice was not marked by economy or celerity; but stenography and typewriting, the phonograph and linotype, have become common since our rules were framed, have made compression and brevity old-fashioned, increased expense, and often swamped bench and bar alike by the quantity rather than the quality of the material offered for consideration.

Motions to expunge and limit cross-examination should have been made in these cases,—though they are feeble remedies exposing counsel to personal reproach, and rendering judges afraid of keeping out of evidence what they cannot (on motion at all events) understand. But the radical difficulty of which this case is a striking (though not singular) example will remain as long as testimony is taken without any authoritative judicial officer present, and responsible for the maintenance of discipline, and the reception or exclusion of testimony.]

Upon one question of law all counsel are agreed; the patent claims under consideration, are all for combinations; there is, of course, no agreement that the combinations set forth are patentable, and none as to the interpretation of their language if valid at all, but there is no denial that in form nothing but combinations are claimed.

This is emphasized because it seems to open and simplify the discussion. Selden does not pretend to have invented any new machine or combination of matter in the same sense that Whitney invented the cotton gin or Howe the sewing machine. He does not in application or claim specify any one mechanical device for which in some branch of art a prototype cannot be found; there had been and were in 1879 running gears, propelling wheels, steering mechanisms, gas

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engines, etc., of many forms, and his patent covers no one form of any of these parts of his "road-locomotive." He does assert that he selected, adapted, modified, co-ordinated, and organized the enumerated parts (including the usual mechanical adjuncts of each part) into a harmonous whole capable of results never before achieved, and of an importance best measured by the asserted fact, that after thirty years no gasoline motor car has been produced that does not depend for success on a selection and organization of parts, identical with or equivalent to that made by him in 1879.

If this be true, it may be held at once that in such a mental operation and such an important result therefrom, invention, and that of a high order, undoubtedly does reside. Where Bradley J. declined definition, he would be a bold man who tried it, but I am sure that invention is easily discernible as that which vitalizes Selden's selection, if that selection and its results have been truly described.

Broadly speaking, the defense in these cases rests on a denial of the truth of the foregoing summary of Selden's performance; which denial has two parts: (1) Selden did not do what he now asserts, and (2) defendants' combinations differ from Selden's, being neither identical nor equivalent.

In considering what Selden did, and the meaning of the words in which he described and claimed his achievement it is to be remembered that whether his combination constitutes invention and whether it possesses novelty and utility are primarily questions of fact, as to which the very grant of the patent raises a presumption in favor of complainants, while the demurrer decision (in Electric Vehicle Co. v. Winton Motor Co., 104 F. R. 814) is here controlling authority to the effect that on its face, plus all matters of which the court can take judicial cognizance, the patent is valid.

To ascertain therefore how far defendants have succeeded in meeting the burden of proof, which in all matters of fact lies on them, it seems fair to begin by discovering from all the evidence what was the state of the art when Selden filed his application in 1879. (Note.)

But what is the art as to which this enquiry is to be made? On this preliminary point it seems to me that defendants' testimony and argument have taken too wide a range, or at least laid undue emphasis on matters of little moment. This invention does not belong to the steam engine art, nor that of any engine regarded alone; nor is it fruitful to examine carefully the development of traction engines, whether primarily designed to haul "trailers," or transport persons and goods over their own wheels. Boats also, and tram cars, propelled by engines of any kind furnish but a limited field for useful investigations; the enquiry is, how stood art (and science too), in 1879, in respect of a self-propelled vehicle with a considerable radius of action over ordinary highways, and capable of management by a single driver and he not necessarily a skilled engineer?

Or (to use a phrase frequently occurring, in the testimony and exhibits), what was known of the "horseless carriage" industry in 1879, either at home or abroad?

The answer given by the evidence is entirely plain,—there was no such industry, the art existed only in talk and hope, no vehicle even faintly fulfilling the requirements above outlined had ever been built, and there is no competent and persuasive evidence that any experiment had ever moved a hundred feet, or revealed an organization warranting the expectation that it ever would do so.

[Note: From uncontradicted testimony 1877 might well be fixed as the date of the invention alleged in this patent application. No anticipation or prior use, however, has been urged during 1877-9,—the experts have throughout spoken of the art of 1879 as controlling, and that time is therefore taken as a convenient starting point.]

Some examination of the kindred arts, above alluded to, serves to explain this situation. For more than one hundred years, steam as a prime motor, had dominated the world of mechanic art. Steam as the power for a self-propelled road vehicle had been exhaustively worked over, and patents obtained, from Trevithick (British 2599 of 1802) to Monnot (U. S. 197485 in 1877); and the result was the traction engine; it made no difference whether it carried passengers or hauled freight, the actual type and only type was a boiler on wheels of enormous weight, slow speed, and small radius of action.

But the numerous experiments with steam road wagons, had (however meager the success attending them) served to make known to that wholly ideal and fictitious person, "the man skilled in the art," something of the organization of any road vehicle capable of operation by a small crew. Steering mechanism operated by wheel before the driver, independent turning of the fore wheels, the chain-drive, as well as bevelled gear connection between power and driving shafts, devices for disconnecting power from running gear and letting engine run free, plans for brake control of quite a modern sort, and stowage of motive power in parts of the vehicle remote from passengers,—all had been practiced or suggested. From patents and publications scattered over two continents and more than two generations there can be reconstructed (and defendants have done it on paper) something that is very far from even a good theoretical road wagon, but which does contain most of the elements of Selden's combination,—and this represents the art, known to the man skilled in both theory and practice, a good mechanic, with a scientific education and widely read in the technical literature of all civilized nations, by whose incredible knowledge the achievements of patentees are so often measured.

Obviously if a fairly good road wagon cannot be reconstructed in 1909, out of materials so industriously collected from the scattered knowledge of 1879, it is desirable to ascertain whether there then existed some one lack, whether the art then required some one thing which was wholly missing,—in order to produce a practical self-propelled road vehicle.

It seems to me plain that there was such lack, and it may be stated in the language of one of the numerous inventors who procured long and elaborate patents relating to road locomotion, and never (so far as this record shows) did anything more.

Savalle (French 77644 in 1867) says in a certificate of addition dated March 16, 1869:

"I have tried to apply to road locomotives, several motors operating by air expanded by the heat produced, either by the explosion of gas, or by air forced over a metallic surface, heated by coal or other combustible, or also by petroleum.

"These divers forms of motors apply perfectly when it concerns the traction of omnibuses of other large vehicles of this kind; but when it is necessary to apply this kind of locomotion to light carriages, only carrying one to six persons or to drive a velocipede, these means become impracticable by the large space which they require."

The lack, the something that had to be supplied before it was worth while to organize the vehicle was the engine. Steam had thus far failed, and this record seems to show that at about the time Savalle wrote, the gas engine as a road wagon motive power began to be mentioned in serious publications, and patent specifications. (Note.)

[Note: In making this statement Le Monde Illustre and Pinkus (British 8207 of 1839) have not been overlooked. The former proves nothing that relates to the form of engine to be considered in this litigation, while the absence of all later mention proves the car a sporadic failure. Pinkus was speaking of tram cars, and the use of such a publication against Selden by the Patent Office, was to say the least, not very intelligent.]

Savelle was much mistaken in asserting that any of the assorted motors mentioned by him had successfully driven an

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omnibus or any similar conveyance, but he early hinted at the truth that in some form of motor actuated by a product of petroleum would be found, if not the immediate solution of the problem, at least the missing element that would make the solution sure.

This missing element Selden avers he discovered, and it follows that over his engine the conflict in these cases has raged through several volumes. In trying to ascertain, however, the status in 1877-9 of engines in any way resembling Selden's, the court is fortunate in having in evidence a book entitled "The Gas Engine," published in 1885 by Mr. Dugald Clerk, who has also testified with admirable clearness as an expert for complainants.

It appears that the materials for this book were gathered during the very period of Selden's experiments, while so completely has Clerk furnished a classic on the history of the gas engine art that even counsel who sharply criticise his evidence, support their arguments from his book to such an extent that it is not too much to say that many chapters thereof could be reconstructed from their briefs.

In 1879 "internal combusition" engines were well known and had reached a considerable degree of commercial success,—despite the fact that the reasons for their success or more frequent failure were very ill-understood.

The fact that fuel might be burned in the engine cylinder itself, that such burning (if of gases), produced an expansion thereof, and that such expansion might be utilized by allowing it to push the piston, was and is the basic proposition.

This knowledge had produced the Lenoir Engine in 1860 and the Hugon in 1865, constructed in close adherence to the steam engine of the day, and giving less than one horsepower per ton of weight. Both normally used illuminating gas at atmospheric pressure.

The Otto free piston engine of 1867 marked an advance in effectiveness, but no form of gas engine had yet appeared, which (so far as shown) was more than suggested as the propulsive power of a road wagon.

In 1861, Million, and a year later Beau de Rochas, Siemens and others pointed out the advantage of compressing the gaseous fuel before ignition in order that the expansion should be both greater and quicker with the greatest possible pressure at the beginning of the expansive movement; and in 1872 Brayton in America, and in 1876 Otto in Europe introduced compression engines, the latter with great commercial success.

The change from a gaseous fuel burning at atmospheric pressure to the same fuel burned under compression was a change of kind, for, though formed of the same chemical elements, the compressed fuel possessed a power when used by men who live by breathing atmospheric air, that uncompressed and commercially possible gases did not and could not exert in any non-compression engine even as yet imagined. It therefore, seems clear that the phrase "compression type," as applied to internal combustion engines, is reasonably indicative of a class, and appropriately describes an unmistakable and invariable species of the genius gas engine. [Note A.)

[Note A. Compression is a relative word. Men can for short periods live and work in a caisson where the air is compressed, but a Lenoir engine if it could operate in the caisson would be a non-compression engine still, though using the air of its immediate environment. It is density of fuel as compared with the air into which the engine exhausts that determines and defines compression. This seems overlooked in some of defendants' cross-examination (Clerk, x-Q. 156-163), and neglected in some portions of their argument.]

The evidence is persuasive that the increasing success of the gas engine, produced in the middle '70's of the last century, repeated dreams (they are no more) of applying a gas engine to a road wagon.

In 1877 Rosenwald (French 116871) made a picture of a brougham having an Otto free piston engine perched in an apparently insecure position between passenger and driver. His is a paper patent only, and is in my opinion clearly shown to be inoperative for reasons of which one only may be mentioned;—the most improved type of Otto engine then known weighed over half a ton per horsepower, he did not use the most improved type, and did not propose any improvement or modification which would have prevented his brougham from going to pieces at the first jar of his motor. (Note B.)

[Note B. Hilton Johnson (Britsh 10 of 1878) and Roberts (British 711 of 1877) are provisional only. If these patentees were not able to complete their own inventions, this court cannot be expected to perceive them.

Menn (French 118109 in 1877) is at best an impossible gas engine, in a structure irrelevant to this case.]

This patent is the suggestion nearest to Selden, and is mentioned for comparison hereafter.

Although by 1879 internal combustion engine had separated into the compression and non-compression classes, they were (and still are) all known as gas engines, irrespective of the condition of their fuel immediately before the work of preparing it for combustion begins. The term originated doubtless when coal gas was the only gaseous fuel known,—but the vapor of petroleum or of any product thereof (gasolene or petrol) is just as much a gas as another, and thirty years ago there was, and there is now, no distinction generally obtaining between engines whose fuel as ordinarily purchased is coal gas, and those using gasoline or crude petroleum, provided that what ultimately burns in the cylinder is that vaporous substance, "capable of expanding indefinitely"—which is gas. (Note.)

[Note: Ency. Brit., 9th Ed. 1878-1889. Vol. 6, p. 310. It is curious and instructive that this publication contains no reference at all to road locomotion by gas engines. Under Steam-engines (Vol. 22, p. 522), see Lenoir, Brayton, Otto and Clerk treated under the sub-head "Gas Engines." This article was evidently written in 1886-7, immediately after the publication of Clerk's book, which is referred to.]

But if the substantial difference between compression and non-compression engines was known and recognized certain other terms of art which have been far too much used in this litigation were non-existent in 1879. A great superstructure of argument has been built upon the difference between "constant pressure" and "constant volume" engines. These terms appear to have been devised by Mr. Clerk, and first used in his book before alluded to, as convenient phrases useful in studying the operation of engines, and classifying their phenomena. The terms are instructive, as is the separation of nouns into declensions and verbs into conjugations, but much of the argument about the words, attaches an undeserved importance to them. In all internal combustion motors, the result of expanding the burning gaseous fuel is to drive the piston; that is—the cylinder chamber in which the expanding gas is confined gives way on the piston side (so to speak): If the piston head offers no more resistance than will permit it to move under the expansive force produced by the initial compression alone, evidently since the piston moved under that pressure, it will be maintained to the end of the stroke, the expansion produced by ignition serving to keep up that "constant pressure."

If, however, the compressed charge must be ignited before the piston moves, then whatever volume thereof is introduced into the cylinder increases (by combustion) its pressure on the piston head, before the engine operates, and the machine is described as "constant volume."

In both phrases "constant" refers to condition, at the instant piston movement begins, compared with that at the moment the fuel charged is inserted. If between the two mo-

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ments pressure increases, then the volume is constant; while if volume increases, pressure is constant.

These conditions are theoretic. If in a constant pressure engine the load or piston resistance is suddenly increased, the expansive power produced by compression alone may not start movement before ignition or explosion,—and accordingly (if too much importance be attached to phrases) the type of engine has changed. Of course nothing of the kind has occurred,—the relation of piston head to cylinder walls relative to time of explosion has changed ,and it may nowadays (in many engines) be changed at will to suit the load and speed by throttling and by timed ignition. These variations have been observed in all the engines testified about in this case. They occur, or may occur, in all compression engines; and are no more significant of specific or generic differences than are variations in rapidity of breath in different men, or in the same man at different times.

From this attempted outline of the knowledge and achievements of 1879 it seems to me that the way was singularly clear for any one who would really produce the thing described in Selden's first claim.

Success is never anticipated by any number of failures, and when it is clearly kept in mind that what Selden claims is a combination, and not any one of its elements, the defendants' references to prior patents and publications may be thus finally disposed of so far as this court is concerned.

Much has been said concerning this inventor's personality and there is some importance therein as showing the likelihood of his comprehending his own experiments, and telling the truth about them. The record shows him always interested in mechanical pursuits, receiving an appropriate education for the theoretical side thereof, but not himself a skilled practical mechanician.

His application for a patent on a rubber tire wheel made in 1869 is significant and interesting, and in view of quite recent litigation in this circuit instructive. Taking his evidence n connection with his letters and notes, he is shown especially attentive to traction problems from his early manhood. I am persuaded that he carefully studied Brayton's engine and understood it practically,—but his knowledge of the theory of thermodynamics seems fairly illustrated by a remark to his workman Gomm when his original engine turned over,—"we have struck a new power." There is no safisfactory evidence that before application filed he knew thoroughly anything of Otto's compression engine. All this was not a very complete equipment, but he had the true inventor's enthusiasm, and for more than five years, (as the Chief Justice said of Morse,—15 How, 108) "he pursued these investigations with unremitting ardor and industry interrupted occasionally by pecuniary embarrassments."

When he was ready to file his applications he had completed and experimenutally operated one cylinder, of a three-cylinder engine of the general type Brayton had patented in 1872 and 1874. He intentionally built a plurality of cylinders, to obviate or minimize the necessity for a flywheel; he produced an enclosed crank case (which immediately reduced weight to an enormous extent) and used a small piston with a short stroke (which made possible the speed that would compensate for the loss of piston head area).

This engine (with allowance for adjuncts Selden did not use) but (as experience has shown) should have used, weighed less than 200 pounds per brake horsepower, as compared with over 800 pounds in the lightest form of Brayton's, and is capable of over 500 revolutions per minute as against less than 250 by any type of gas engine known, built or suggested in 1879.

These I find to be the facts regarding the engine built by Selden before application filed. He then caused to be made a model and mechanical drawing of his suggested vehicle and actual engine and submitted the same with specification and claims to the Commissioner of Patents.

Avoiding for the present the language of his original application, and the effect of the numerous changes therein during its many years in the Patent Office, was the thing fairly revealed by the model and drawings, and conceived under the circumstances above set forth,—the embodiment of a combination patentable in 1879?

I thing the answer is emphatically yes; that which is not obvious to skillful men is usually (as remarked by Mr. Clerk in his evidence) invention, and certainly what Selden shows in his model, and by the drawings which have remained unchanged for thirty years, is anything but obvious. The inventive act is shown by comparing Selden and Rosenwald. If the latter's brougham had actually carried its engine, and traveled even a little, he might nevertheless (on defendants' own argument) have found his patent invalid by American law, because each part of his vehicle was doing just what it had always done, without any new "Co-operative law," while his engine in particular was the same motor which before it was applied to the brougham, had perchance driven a lathe and might tomorrow do something else. Rosenwald might have been held a mere aggregator (however successful), but Selden's combination cannot be taken apart, and each element recognized as something that had done the same thing or sort of thing before.

The adaptation of the engine alone, was something never before attempted (so far as shown); such adaptation might have involved an infringement on Brayton, but that did not prevent Selden's combination from being strikingly new, useful if it would work, and eminently patentable.

To sum up what is shown to have been the mental concept embodied in 1879 by Selden's model and drawings;—with Brayton's engine in mind he organized a new road vehicle; to be sure he did substitute one old and well known prime mover (gas) for another (steam), but in so doing he devised and used an arrangement of Brayton's engine never before attempted, one that Brayton himself never suggested, made or patented, and without which the road vehicle was an impossibility.

This mental concept constituted invention, if capable of reduction to operation, and if any operative example (not all operative examples) thereof was shown by the patentee.

If this doctrine be admitted or found, defendants before attacking the operativeness of Selden's vehicle seek to limit the scope of the patent by asserting that the combination is not infringed by any vehicle whose engine is not substantially identical with that described in drawings and specifications,—notwithstanding the language of the claim "liquid hydro-carbon gas engine of the compression type."

Thus it is asserted, that since Seldon and Brayton show a spray of petroleum mixed with and carried by compressed air into the combustion chamber,—they do not show a true gas engine; that the use of a carbureter separate from the engine proper and producing gaseous mixture which it feeds to the engine is something outside the patent and avoiding infringement; that a water jacket being shown by Selden in a peculiar and unusual equivalent or attempted equivalent is something outside the combination, and when used by defendant differentiates defendants' engine and combination from anything that infringes; and that since Selden evidently shows in his drawings ignition by a constant flame, he is confined thereto, and cannot use electric ignition, while defendants by using the same do vary the combination.

I have already tried to show that Brayton's petroleum engine, Lenoir's illuminating gas engine, and an Otto machine driven by gasoline, are now, and were in 1879, not only "gas engines" in the sense that they all operate on the same scientific principles, but they were known as and called "gas engines" by those best qualified to speak.

To make gas in one place rather than another must be an immaterial variation, where a primary patent (such as this by complainants' contention) is under consideration; wa-

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ter jackets were old in 1879, and had been used inmany forms and both flame and electric ignition had been used and were well known to gas engineers of the day, although in 1879 it seems to me that the flame method was by far more successful than the electric as applied to compression machines.

The force of these objections based on the face of the drawings and specifications, as compared with the claims, depends on whether the patent is viewed as a primary or pioneer one, or the contrary, and this in turn depends on the state of the art at the time of invention.

The art I have attempted to describe at perhaps too great length, because upon its condition this whole litigation seems to hinge.

If I have correctly apprehended it, there was clearly room for a pioneer patent, and it must now be held that on its face and in view of the art, Selden's is such a patent. This means that Selden is entitled to a broad range of equivalents, and this rule as applied here results in this crucial inquiry; was Selden (or any one else) entitled in 1879 to appropriate as one of the elements of any patentable combination a "liquid hydro-carbon gas engine of the compression type."

I think he was, and so was any other inventor, but he was the first so to do. If this be true, then the use or disuse of any then well known mechanical appliance which will increase the efficiency, usefulness or commercial success of such combination, without changing what defendants call its co-operative law (Note) is on the one hand open to Selden, and on the other will not free defendants from infringement.

[Note: This phrase which runs through all defendants' argument, seems to be defined (Main brief p. 157), as "a new mode of operation," referring to Rapp v. Central, etc., Co., 158 F. R. 440. It is insisted that Selden's combination introduced no new "co-operative law" and must therefore fail. The trouble with this argument is, that there never was such a combination as Selden's before 1879, and there is nothing to compare it with but paper projects and admitted failures.

The same phrase is repeatedly used, when quoting ex parte Faure 52 Of. Gaz. 772. If Selden had merely utilized Brayton's existing engine to drive a wagon, the doctrine of the case cited might have applied. Perhaps it would have been good American law against Rosenwald, but if Selden selected, adapted and united old elements to produce a new result, the phrase is inapplicable.]

Although there were in 1879 many liquid hydro-carbon gas engines of the compression type, there was not one which in its then form could be made an element (and the most important element) in a road wagon combination, and the radical difficulty was the same that Savelle had confessed to ten years before.

Selden (on paper certainly, whether actually will be considered later) solved that difficulty, and such solution gave him the right to claim broadly the thing which was the leading element in his invention—when used in his combination. Thirty years have passed, and counsel admit that no successful gasolene motor car fails to use a liquid hydro-carbon gas engine—of the compression type—with a short rapid stroke, and enclosed crank case, and a plurality of cylinders.

These are the very things which are at the foundation of success. To be sure (as will be considered more fully later) no very great degree of success can be reached without improvement over 1879 in carbureters, and electric ignition, and increase of knowledge concerning the respective mechanical possibilities of two, four and six cycle engines; the faster also the reciprocating parts of an engine move the greater the necessity of constant and abundant lubrication, and Selden's lubrication is confessedly primitive, and finally the great difference between any results Selden's most optimistic supporter can claim for him in 1879, and the successes of 1909, arises from increased compression, so that engine weight per brake horsepower has now been reduced to about ten pounds.

But these are non-essential; if in 1879, Selden could lawfully use as an element in his patentable combination, the "compression type," or species of a whole genus of engines. As already stated, I think he could, and did, and further showed and made an exemplar of said "type." (Note.)

[Note: As quite possible my foregoing efforts to follow defendants' argument on the interpretation of the specification and claims in the combined light of prior and present art—have failed to complete success, the following statement may be excused. Defendants seem continually to assume (without saying so) that Selden invented nothing more than a modified Brayton engine, and then assert that they do not infringe because they do not use that particular motor, and do use a modified Otto. They admit that the claim is for a combination, but continually seek refuge in defences that would be good against any patent on Selden's engine, but are worthless against the combination if it be patentable at all. Mr. Selden is a member of the bar, especially devoted to patent causes, he seems to have been his own solicitor during most of his contests with examiners over this application, and the clearly and simply worded claims in suit are good professional work. He has avoided the trap into which Morse fell (O'Reilly vs. Morse, 15 How., 62), and thereby lost most of the fruits of his efforts. This case seems to me suggestive, in that the Chief Justice several times speaks of process as legally synonymous with combination, and see Morse's claim restated so as to avoid the criticism that destroyed it in 19 Harv.-Law Review, p. 37. I think Selden might have patented his engine as an improvement on Brayton, but he would have had to pay Brayton a royalty, and these suits would certainly never have been possible.]

Thus far the claims and specifications have been treated as though they were presented to the Commissioner in 1879, in the shape they left his office in 1895. This was not the case; nothing remained in '95 of the language of '79 but the descriptions of the vehicle and engine (and not all of that); the claims were reworded and the specification amplified many times, and usually after a rejection made or criticism offered by the Examiner, Selden did nothing by way of amendment or reply for about two years—the extreme limit of inactivity permitted him by these rules of Patent Office practice.

By these means he received in 1895 a patent for an invention of 1879, and in the meantime had never built a motor car, and never succeeded in getting any one sufficiently interested in his theories to experimentally try them out with larger means and better mechanical ideas than Selden himself had.

During the later years of this period, and while Selden was in very leisurely fashion combating examiners, who evidently had small conception of what was meant by light self propelling vehicles usuable on the common roads, Duryea, Olds, Ford and others in America, the Panhard and Peugeot companies (and many others) in France were experimenting with actual cars, and in 1894 a public race-meet was held in France, whereat cars now as archaic in appearance as Selden's, demonstrated that they actually could propel themselves from Paris to Rouen at about twelve miles an hour. The engines of some of them were modified Ottos, and "liquid hydro-carbon gas engines of the compression type," and it must be found that when Selden's patent issued there had been developed engines answering to his phrase, which as matter of history, are not derived from his engine—that others reached his type without knowledge of him or his labors; indeed (while certainty is impossible) it is my belief from this evidence that Selden had contributed little to motor car advancement in the United States, and nothing at all abroad. As matter of fact, I believe that nearly all the cars made in the United States when these actions began, were modeled on French ideas; and used engines descended from Otto through Daimler, and not from Brayton, through Selden or any other American. In short, this American patent repre-

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sents to me a great idea, conceived in 1879, which lay absolutely fallow until 1895, was until then concealed in a file wrapper, and is now demanding tribute from later independent inventors (for the most part foreign) who more promptly and far more successfully reduced their ideas to practice.

But the patent speaks from the date of its issue, and unless Selden did something unlawful during his sixteen years wrangle with Examiners, or unless intervening American rights, available to defendants, sprang up while Selden was rewording claims—he is within the law, and his rights are the same as those of the promptest applicant.

Without prolonging discussion, it may be held briefly that Selden did not overstep the law. He did delay, he was not in a hurry. He could not get any one to back him, and doubtless appreciated that if he was ahead of the times, it was wise not to let his patent get ahead too. If he had gotten his grant in 1880, without a moneyed backer—the patent might and probably would have expired or nearly so before any one saw its possibilities; and if the business world had seen them within seventeen years, that term would then so nearly have expired, that Selden would never have been able to get to final hearing before it ran out. At best, an accounting and not an injunction would have been his lot. The difference he may well have considered as a lawyer, and personally I believe he did think of it.

If he did not delay unlawfully, what intervening rights did he permit to spring up?

Remembering that Selden clearly showed a "liquid hydro-carbon gas engine of the compression type" in 1879, and actually manufactured one, I think it clear that his original claim was wider than any of those in suit.

The third claim as originally filed read thus:

"The combination in a road locomotive provided with suitable running gear and steering mechanism, of a gas engine, traction wheels, and an intermediate clutch or disengaging device, substantially as set forth."

It is true that throughout the original papers, he speaks continuously of "Gas Engine L," that being the alphabetical designation given his motor in the drawing submitted, but the claim quoted shows how wide was his original demand, and without further elaboration I hold with complainants that all subsequent changes of claims are in diminution or contraction of this first statement of invention.

The file wrapper, cross examination thereon, and argument concerning it form a bulky volume, but it seems to me sufficient to quote from the amendment of June 6, 1889, when Selden amplified his specification by inserting the following:

" I have succeded in overcoming these difficulties by the construction of a road-locomtive propelled by a liquid-hydro-carbon engine of the compression type of a design which permits it to be operated in connection with the running-gear, so that the full carrying capacity of the body of the vehicle can be utilized for the transport of persons or goods, and which, by dispensing with skilled attendance and with steam-boilers, water, water-tanks, coal, and coal-bunkers, very largely reduce the weight of the machine in proportion to the power produced and enables me, while employing the most condensed form of fuel, to produce a power road-wagon which differs but little in appearance from and is not materially heavier than the carriage in common use, is capable of being managed by persons of ordinary skill at a minimum of trouble and expense, and which possesses sufficient power to overcome any usual inclination," and at the same time he put what is now Claim 1 into substantially its present shape.

The language last quoted is in the final specification, it describes the thing which Selden conceived and pictured in 1879; and in 1889, the man skilled in the art though he knew more than he did in 1879, did not know as much as Selden sets forth in the quoted words. It was still possible for the gasolene compression engine to be made part of a patentable road wagon combination. No one in the United States had passed, or even caught up with Selden—while foreign efforts have been fairly and attractively told by Mr. Krebs of the Panhard Company. He quite fully depicts the history of meritorious and successful efforts in road locomotion apparently as ingenious as Selden's and more vigorously pursued, but they did not begin until after 1879, and in 1889 were still clearly behind Selden's concept. (Note).

[Note: It is not intended to admit or assert by this, that even if some one had between 1879 and 1889 devised an engine or a combination, which if devised in 1689 would have been a clear anticipation of Selden, that such person's device would be a defense on these suits.

The fact that no such device exists renders discussion of this point unnecessary. Benz has not been overlooked, but is not thought to require further mention.]

Defendants have advanced many other arguments based on the contents of the file wrapper.

Thus the original third claim above set forth, declares a combination in a road locomotive, while the first claim in suit covers a combination with a road locomotive. The change is declared to be an abandonment of the original combination. It is further shown that some patent examiner rejected certain claims, referring to the Pinkus patent (supra), and thereupon Selden amended the claims and disavowed and disclaimed Pinkus. The argument based on this is that since Pinkus' "Co-operative law" is the same as Selden's, the disclaimer of Pinkus was in effect an abandonment of the very combination now relied on.

I have already indicated my view of the major premise of the last proposition, but these arguments and many others of the same ilk, cannot prevail if it be true that Selden clearly showed in 1879 the thing he had invented. If so, he could rewrite the description of that thing as many times as the rules of practice permitted down to 1895. That such rewriting is all Selden did I believe to be true.

Defendants now urge that Selden's invention is inoperative. The one cylinder engine built by Selden on the three cylinder casting in 1877-8 was put in evidence as Exhibit 47. Thereafter the cylinders of Exhibit 47 were all bored out or rebored, new working parts fitted to them, and the engine put into a vehicle, the whole called Exhibit 89, completed in the winter of 1905-6, and constituting the first physical embodiment of Selden's patent. The complainant licensee Electric Vehicle Co., also constructed a new engine from the patent drawings (Exhibit 132) and a complete vehicle (Exhibit 157).

Defendants aver that neither of these vehicles is a Chinese reproduction of Selden's drawings, and have devoted volumes of print to recording and arguing about the performances of Exhibit 89.

In my opinion Exhibit 89 as constructed was such Chinese reproduction, Exhibit 157 was not—complainants having changed the water cooling device, used only electric ignition and made some other departures from the mechanical details shown in the drawings. But these variations were (as previously indicated) within the range of equivalent permitted to a primary patent. (Note.)

[Note: Great complaint is made of the "destruction" of Exhibit 47, and after defendants learned of the construction of Exhibit 89, they frequently demanded that Exhibit 47 be produced, knowing that it could not be done. I can see no force in the complaint; the function of an exhibit is to furnish evidential information, and it is too obvious for argument that whatever value (it is not much) Exhibit 47 has, it was enhanced by building even the re-bored cylinders into Exhibit 89. It may also be noted here that in my opinion Selden's original drawings indicate the existence of a check—or wicket-valve in the appropriate place. It was a well known and perfectly simple mechanical adjunct, it should have been there, it was by no means the key of the invention, and Rebasz's testimony is probable and uncontradicted.

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The so-called Ford-Lenoir machine has received attention. To me it is interesting but irrelevant. Mr. Clerk did intimate that he doubted whether any vehicle with a non-compression engine could move at all. Mr. Ford has shown that he was mistaken. By making the engine four times the size of Ford's compression type, there is obtained about one-seventh of the power. It hardly seems that the pleasure of contradicting Clerk was worth so much trouble.]

The evidence on the subject of operativeness is the most flagrant example of unsupervised testifying I have ever seen or heard of.

Whether in 1905 Exhibit 47 was any better than scrap, whether Exhibit 89 would start on flame ignition, whether Exhibit 132 showed diagrams revealing volume or pressure constant, were perhaps interesting, but unimportant questions. They raised a false issue over which months of time and volumes of print have been expended.

The serious and I think only question was and is whether a machine made in substantial conformity to drawings and specifications, without going beyond the range of equivalents permitted, was operative, even though rudimentary. Exhibit 157 answers to this description, and its performances may, I think, be thus summarized—it is a wretchedly poor car for 1905, there were probably as good, if not better cars in 1895, but it is a marvel of invention for 1879—and that is more than enough for the purposes of these cases.

One instance of alleged prior use remains. Before 1879 Brayton undertook to furnish an engine which would drive an omnibus to certain men in Pittsburg. It is shown that he endeavored to adapt his then well known engine to traction purposes. That he failed utterly is clearly proved; the reasons for his failure are not so clear, but the failure is enough to invalidate the defense.

No litigation closely resembling these cases has been shown to the court, and no instance is known to me of an idea being buried in the patent office until the world caught up to and passed it, and then embodied in a patent only useful for tribute.

But patents are granted for inventions, the inventor may use his discovery, or he may not, but no one else can use it for seventeen years. That seventeen years begins whenever the the United States so decrees by its patent grant. That the applicant for patent rights acquiesces in delay, or even desires delay, is immaterial to the Courts so long as the statute law is not violated. On these principles complainants are entitled to a decree. (Note.)

[Note: The legal principles relied on are so simple, (the difficulty being only with the opinion evidence) that it has not seemed necessary to quote from decisions. The leading cases considered are (as to nature and act of invention) Smith v. Dental Vulcanite Co., 93 U. S. 486; Loom Co. v. Higgins, 105 U. S., 580; Potts v. Creager, 155 U. S. 597; (as to probative value of references) Seymour v. Osborn, 11 Wall, 516; (as to meaning of "pioneer" patent, and effect of file-wrapper) Hobbs v. Beach, 180 U. S., 383; (effect of delay in patent office) U. S. v. Bell Telephone Co., 167 U. S., 224; (right to deny use to others while patentee not using). The Continental Paper Bag Company v. Eastern Paper Bag Company, 210 U. S. 424.]

The Panhard machine does not in my judgment infringe the second claim. Construed as they have been in this opinion, infringement of claims one, two and five by the Ford machine, and of one and five by the Panhard can hardly be said to be denied. It is so found, and decrees will pass accordingly.

C. M. HOUGH, U. S. D. J.

September 8th, 1909.

A firm of tobacco merchants in Wheeling, W. Va., has decided to furnish each of its 75 salesmen with motor vehicles.

A BILLION DOLLARS FOR GOOD ROADS.

ARTHUR HOOKER, secretary of the board of control of the National Irrigation Congress, will present a resolution memorializing Congress to issue 3 per cent gold bonds, running 100 years, to the amount of $5,000,000,000, or as much thereof as may be necessary, for the following purposes:

One billion dollars for drainage of overflow and swamp lands.

One billion dollars for the reclamation by irrigation of 40,000,000 acres of arid and semi-arid lands, now partly or wholly waste.

One billion dollars to construct and improve deep waterways, to develop thousands of miles of territory now without adequate transportation facilities.

One billion dollars for good roads and national highways, for the lack of which the loss to the farm area of the United States is approximately $500,000,000 annually.

One billion dollars for forest protection, reforestation and conservation of the forest resources, thus assuring timber and lumber supplies for centuries to come.

"No one," says Mr. Hooker, "questions the statement that good roads have a high money value to the farmers of the nation, and it may be said that this alone is sufficient to justify the cost of their construction as rapidly as practicable under an efficient, economical and equitable system of highway improvement. The big points in favor of this expenditure are the economy of time and force in transportation between farm and market, enabling the growers to take advantage of fluctuations in buying and selling, as well as enhancing the value of real estate. It is estimated that the average annual loss from poor roads is 76 cents an acre, while the estimated average increase resulting from improving all the public roads is $9. The losses in five years would aggregate $2,432 for every section of land, or more than enough to improve two miles of public highway. The necessity of good roads is obvious, as it would enhance the value of each section of land about $5,760, or more than double the estimated cost of the two miles of improved highway, which constitutes the quota for 640 acres of land."

The board of public safety in New Britain, Conn., favors the installation of a $4,000 motor hose and chemical wagon.

Motor bus service has been established between Gallatin and Dixon Springs in Tennessee. The two points are 23 miles apart.

The Palace Livery and Boarding Stables in Peoria, Ill., will soon be equipped with Sultan motor cabs.

The Automobile Service Company has been formed in Camden, N. J., with capital stock of $50,000, to operate motor cabs.

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Care of Storage Batteries

Text of paper read before Society of Automobile Engineers, by H. M. Beck.

WITH the rapid increase in the number of electric vehicles the question of the proper operation and care of the storage battery becomes one of increased importance, as the best vehicle will not run if the battery goes wrong. While under normal conditions the care of a battery is a comparatively simple matter, it must not on this account be entirely overlooked, and unfortunately there has been some tendency recently to minimize the actual attention required. This policy is not new, having been tried in other lines of battery work, and if continued is sure to result disastrously. Why not rather admit that a certain amount of attention is required and insist upon it? The best battery can be ruined in a comparatively few charges or discharges, where it would have given a long life with proper treatment.

The instruction books furnished by the manufacturers go into the operation and care of vehicle batteries very completely, and as they have been revised from time to time, one of them now being in its sixteenth edition, they are up to date. It will not be necessary therefore to go into many of the details of operation, but there are certain points which are either frequently misunderstood or else on which it would be well to lay special emphasis, as their importance has apparently not been appreciated.

Nature of the Battery.

An electric storage battery is chemical in its nature rather than mechanical and must not therefore be confused with mechanical apparatus. The latter gives much more marked warning when it requires attention, and the fact that a battery may be apparently operating perfectly when it requires attention is responsible for a great deal of battery trouble. When a battery finally breaks down permanent injury has been done, and although it can generally be doctored back into shape, it cannot be made to give the life it should have given. In probably no line of technical work is prevention rather than cure of so vital importance. Unfortunately the chemical theory of the storage battery never has been definitely settled, but an approximate idea of what goes on during charge and discharge can be easily stated.

A storage battery from an elementary standpoint consists of two or more plates, positive and negative, insulated from each other and submerged in a jar of dilute sulphuric acid. The plates consist of finely divided lead known as the active material held in grids which serve both as supports and as conductors for the active material. The active material being finely divided offers an enormous surface to the electrolyte and thus electro-chemical action can take place easily and quickly. Two plates such as described would have no potential difference, the active material of each being the same. If, however, current from an outside source is passed between them, one, the positive, will become oxidized, while the other remains as before, pure lead. This combination will be found to have a potential difference of about 2 volts, and if connected through an external circuit, current will flow. During discharge the oxidized plate loses its oxygen and both plates will become sulphated until, if the discharge is carried far enough, both plates will again become chemically alike, the active material consisting of lead sulphate. On again charging, the sulphate is driven out of both plates and the positive plate oxidized, and this cycle can be repeated as often as desired until the plates are worn out. Thus charging and discharging simply results in a chemical change in the active material and electrolyte, and the potential difference between the plates and capacity is due to this change.

Charging and Discharging.

In taking care of a storage battery there are four points which are of the first importance: First, the battery must be charged properly; second, the battery must not be overdischarged; third, short circuits between the plates or from sediment under them must be prevented; and, fourth, the plates must be kept covered with electrolyte and only water of the proper purity used for replacing evaporation.

Although, as already stated, it is impossible to give an accurate formula for the chemical changes which take place in a storage battery during charge and discharge, certain facts dependent upon these are well established and are used as a basis for operation. These are the following:

Voltage: During charge the voltage of a battery gradually increases until the cells are fully charged, but it will then come to a standstill and will not rise any higher, no matter how long the charge is continued. The maximum voltage thus reached is not a fixed point, varying widely at different times, depending upon the age of the battery, the temperature, the strength of the electrolyte and the charging rate.

During discharge the voltage falls and if the discharge were carried far enough, it would reach zero, but experience has shown that this point is much too low for safety, resulting in the rapid destruction of the plates.

Specific Gravity and Gassing.

Due to the fact that during discharge the active material of both plates becomes sulphated, the specific gravity of the electrolyte falls. During charge the reverse process goes on, the sulphate is driven out, and the specific gravity of the electrolyte rises. As with the voltage, the gravity will rise gradually during charge until all the sulphate is driven out of the plates, but will then show no further increase, no matter how long the charge is continued. The maximum gravity thus obtained is also a variable figure, depending upon the temperature of the electrolyte as well as upon the actual amount of acid and water present in the cell.

The fall in gravity is almost proportional to the ampere-hour discharge; in other words, specific gravity readings can be used as an ampere-hour meter, but unfor-

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tunately, gravity readings are difficult or disagreeable to obtain in the case of vehicle batteries, so that this check on the discharge is not frequently used.

Gassing: Until nearly charged the plates in a storage battery should absorb the energy put into them with little or no gassing. When they are nearly charged the energy instead of being stored shows itself in the form of more or less gassing, the amount depending upon the rate of charge. During discharge a cell should never gas. If it does so, it is an indication that it has been run down much too low and needs immediate attention.

Voltage and Gravity Readings.

Of the above indications, the first two, voltage and gravity, are those most commonly employed in operating. Gassing, while of great assistance as a guide or warning, cannot be depended upon for accurate results, and is only used when nothing but the most crude methods of operation are practical.

Either voltage or gravity readings alone could be used, but as both have advantges in certain cases, and disadvantages in others, it is advisable to use each for the purpose for which it is best fitted, the one serving as a check on the other.

Voltage has the great disadvantage in that it is dependent upon the rate of current flowing. Open-circuit readings are of no value, as a cell reads almost the same discharged as it does charged. On the other hand, a voltmeter is a very easy instrument to read and may be located wherever desirable.

Specific gravity readings are almost independent of the current flowing, but the hydrometer is difficult to read, not very sensitive and the readings must be taken directly at the cells.

Proper Charging Prolongs Life of Plates.

In the case of the pasted type of plates used almost entirely in vehicle service, experience has shown that the manner of charging has much to do with the life of the plates, and on this account it is sometimes stated that the life of a vehicle cell is proportional to the number of charges, rather than the number of discharges. On this account it is wise to charge the cells as moderately as practical. On the other hand, it has been found that if the plates are to be kept in good condition, it is necessary to occasionally charge them to a maximum, thus reducing all the sulphate. Also the different cells of a battery work as independent units, and while their efficiencies are approximately the same, there is generally some slight variation, which if the cells are charged on a very efficient basis, will sooner or later cause irregularity, the cells with the lowest efficiency dropping behind. It is necessary, therefore, occasionally to even them up or the low cells will get in trouble. To meet these conditions, charges are divided into two classes—regular charges, which should be as efficient as possible, and overcharges given at stated intervals, which are carried to a maximum voltage and gravity intended to reduce all the sulphate in plates and even up any irregularity in the cells.

Charging New Batteries.

Initial charge: New batteries are usually received in a charged condition, but when this is not the case, the plates being shipped dry, or where the battery has been taken out of commission, it requires an initial charge before it is ready for service. This charge is not a complicated matter, but requires considerable time, frequently over 100 hours, and there is a very general tendency to cut it short. When the initial charge is not complete the plates will not be properly formed, a certain amount of sulphate will remain in them which will produce local action, and the capacity and life of the cells will be materially reduced.

In regular operation it is well to charge at the lowest possible rate. A large part of the wear on the plates is caused by the gassing, and the amount of gassing is reduced by a lower rate of current. Since the gassing occurs almost entirely near the end of the charge, it is especially important that the charging rate be low at this point, so that when the available time is limited, the necessary number of ampere hours can be gotten into the battery with the least possible wear by having the current rate high at the beginning of the charge and low at the end.

There is one point in connection with the charge which should be especially emphasized—namely: that the final voltage corresponding to a full charge is not a fixed figure, but varies widely, depending upon the charging rate, the temperature, the strength of the electrolyte and the age of the battery. For this reason charging to a fixed voltage is unreliable and likely to result disastrously. The charge should be continued until the voltage or gravity cease rising, no matter what actual figures are reached. Old cells at high temperatures may not go above 2.4 volts per cell, whereas if very cold, they have been known to run up to 3 volts.

Four Rules for Charging.

The points to be especially emphasized in connection with the charge are:

First—On regular charges keep the rates as low as practical and cut off the current promptly. It is preferable to cut off a little too soon rather than to run too long where there is any question.

Second—Overcharges must be given at stated intervals and continued to a complete maximum. They should be cut off at the proper point, but when in doubt it is safer to run too long, rather than to cut off too soon.

Third—Do not limit the charge by fixed voltage.

Fourth—Keep the temperature within safe limits.

(To be continued.)

Motor bus service is to be established between Clearspring and Hagerstown, Md.

A company with capital stock of $25,000 has been formed to supply motor bus service between Aberdeen and Hoguiam, Wash. Seven or eight machines will be employed.

A motor hose and chemical wagon has been installed in the Denver fire department service. It carries 2,000 feet of hose and two ladders, cost $5,000, and has a potential speed of 50 miles on level ground.

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Test of Fitness For Cab Drivers

Measure to be presented to the Chicago Council for the betterment of public vehicle service.

AT the next meeting of the Chicago council an ordinance will be introduced for the purpose of compelling motor cab drivers to prove their fitness for duty in public service. If the measure becomes a law a driver will have to conform to the following rules:

He must have the free and full use of both arms, both hands, both legs, and both feet, and shall not be less than 18 years of age.

He must have good eyesight. If the vision is corrected by glasses, such glasses must be securely fastened to the head by spectacle frames.

He must have good hearing, and must not be addicted to the excessive use of alcoholic liquors or drugs.

He must not be of reckless disposition or subject to fainting fits.

He must be able to guide his machine through crowded streets, and must show ability for quick and decisive handling of such machine in emergencies.

He must state type of machine to be operated, must describe all appliances of machine for stopping, turning and starting the same; and he must show complete knowledge of and acquaintance with its method of operation under all conditions.

He must state his experience in operating such machine and record of accidents suffered, if any.

He must be familiar with the laws of the state of Illinois and with the ordinances of the city and the use of the public streets.

Application for a certificate must be indorsed by two responsible citizens, who will certify that the applicant is a man of good habits, honest, sober, and industrious, and fit to drive a public machine. Upon the issuance of a certificate the driver must execute a bond, the amount of which will be fixed later, which shall be conditioned on his observance of all laws and ordinances governing automobiles.

A fine for the violation of any of these laws or ordinances will cause the revocation of a driver's license, and his driving of any car not covered by his certificate will subject him to a fine of from $5 to $50 for each offense.

An examination fee of $3 is fixed by the ordinance, with a fee of $1 for a renewal of a license, which does not require another examination.

This measure does not include a provision against intoxication, as that is included in the state motor vehicle act. It is probable that in committee another amendment will be added requiring each licensed driver to report all accidents to his machine within twenty-four hours of their occurrence. An amendment to the garage ordinance will require garage proprietors to report what drivers handled the garage machines during the day.

* * *

"As matters now stand," says the corporation counsel, "all a man has to do to have the legal right to drive an automobile in the streets of Chicago is to mail $1 to Springfield and his license will come back, no matter if he is blind, deaf, and paralyzed. Since the passage of the motor vehicle act of 1907 the city has no right to license or control automobiles used for private purposes only, but that law specifically conserves to the city the right to license and regulate automobiles offered for hire—that is, for common carrier purposes. That gives us the right to prescribe as severe a test—both mentally and physically—as we think necessary to keep the taxicab drivers from killing and maiming people, as they have been doing. We also can provide for a revocation of a man's license in case of carelessness or if he is found driving his car while intoxicated. We even could revoke the license of a man found drinking while on duty."

* * *

So long as city authorities confine their attention to improving the breed of motor cab drivers no protest will be heard either from the public or tradesmen. But if the police are to become the arbiters of public service vehicle design, as they are in London, the retardation of an important industry is to be anticipated. The control which Scotland Yard exercises over the motor cab and bus service of London is rather oppressively administered. Both manufacturers and operators are caused heavy loss by the inconstancy of official opinion concerning vehicle design. A graphic picture of these hardships is presented by a writer in the "Commercial Motor," who says:

"Both manufacturers and users are beginning to wonder whether Scotland Yard really knows its own mind in regard to the motor cab regulations and their enforcement, and are asking who is the genius responsible for measurements, equipment, etc., seeing that these regulations are being chopped and changed about, till the poor cab builder 'dunno' w'ere 'e are.' Who, for instance, in spite of the representations of the manufacturers that, the 25-foot turning movement called for, was largely impracticable, insisted upon retaining a 32-inch distance between front springs? This pedantic regulation has now been altered, but not before a number of manufacturers had been put to a lot of needless expense.

"Experience with the authorities in connection with omnibuses had taught manufacturers that those entrusted with the passing of public-service vehicles were often veritable martinets in regard to detail. Makers who were contemplating entering the cab-building business felt it was useless attempting to get cabs passed which did not, in the smallest particular, conform to the regulations; so there was apparently nothing for them to do—the representations of their representatives having failed—but to design closely to the regulations. They then found that, in order to get the 25-foot lock on their vehicles, it was not possible to build as they, as practical men, would have preferred. In traffic, they naturally argued that, so long as a car was possessed of sufficient stability, a fairly narrow vehicle was more desirable than a wide one, economising in road space and enabling the car to get through traffic openings the more readily, and, as they were al-

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ready building their regular cars to a track of 4 feet 2 inches, or 4 feet 4 inches, these widths were considered most desirable. But the 32-inch spring-width, with the 25-foot lock, could not be combined in a vehicle of this width. Makers who cater for this trade had to redesign their entire vehicles, getting wheel-tracks of 4 feet 9 inches and 4 feet 10 inches as the result, and, when they had done all this work and gone to all this expense, lo and behold! Scotland Yard issues a new set of regulations in which, instead of insisting on French constructors building to official measurements, the regulations were altered to suit French specifications and only called for 26 inches! Now, why couldn't they have done this at first? And why couldn't they have notified British manufacturers of the alteration? It would have saved some of them a lot of expense, and a lot of valuable time.

"The 32-inch rule, it is understood, was insisted on to secure stability, and the alteration has probably been made because experience with Renault cabs has shown that the stability was sufficient with the narrower and more practicable figuring. It is true that British makers have now got vehicles with greater stability than their foreign rivals, but what is good enough for the foreigners should be good enough for us, for the customer will most certainly not consider this greater stability as an argument in buying, if all other considerations are equal.

"Then there is another matter which seems very absurd and affects everyone alike, though perhaps rougher on the user than on the manufacturer. The 'Yard' people duly passed and licensed the cabs as we see them on the streets today, with a fold-down emergency seat in front, inside, and with the driver's seat running the full width of the cab; yet, when the unfortunate motor cabman occupies either of these seats with a 'fare,' down comes Scotland Yard on his head like a hundred of bricks and runs him in for taking more than the two passengers he is licensed to carry. Why license a cab with these extra seats if no one is to be allowed to sit on them? It is no uncommon sight to see three people crowded into a hansom, someone sitting beside the driver of a 'growler.' Where there is a horse in question, a case of overloading and consequent cruelty to animals may arise, but this has no bearing when a motor cab is the conveying agent. Why make fish of one and fowl of another? Why not license a vehicle to carry the number of passengers its constructors have designed it to carry?

"The powers that be are now withdrawing the licenses of a number of cabs, till they have had the shoddy cloth linings with which they are fitted taken out and retrimmed in leather. There is nothing much to object to in this, save that it has not been done before. In stipulating for leather the authorities are doing the right thing. It is what coachbuilders who know their business have been urging all along. They knew perfectly well that cloth linings, and cheap cloth linings like the French constructors were fitting in particular, would harbor dust, and dirt, and microbes, and would soon wear shabby. But Scotland Yard had passed the cloth linings, and the French bodybuilders, quoting on that, were able to undersell their rivals, and cab buyers, in many cases knowing little and caring less about anything save first cost, accepted the lower quotations of the French houses for an inferior article, on the principle that what was good enough for Scotland Yard was good enough for them, and so a considerable amount of trade has been lost to the British coach builder this past year which would probably have been retained had the "Yard" been a little more practical in its ideas. It is admitted that the object of the regulations is to secure the safety and comfort of the traveling public, and in this particular instance it would have been better and less misleading to the cab trade had the opinion of some practical man on the subject been consulted.

"There is another matter which just now is a source of considerable worry to the manufacturers, and that is the powers which the authorities reserve to themselves, and occasionally exercise, to refuse to pass vehicles for reasons which find no place in the regulations at all. Many of those reasons, when they are made apparent by refusals, are considered by the cab trade to be arbitrary. At present makers may work with the regulations in front of them, get every detail right in accordance therewith, and yet have no reasonable assurance that their cabs will pass muster. Seeing that a refusal for some trivial and hitherto unheard of objection may cost the maker a good many sovereigns, especially if his headquarters are other than in London, makers feel that they are, to an extent, working in the dark, and are not being treated fairly. The difficulties of the position in the motor trade today are quite enough, without having too much red tape wound round about it."

* * *

The police test of a motor cab's driver's fitness for duty in London is worth considering in view of the attempt being made here to afford adequate protection for the public. The candidate desiring license to drive a London machine must first present himself at Scotland Yard, when a form is filled up, stating name, address, age, height, color of eyes, and description of complexion. He is then presented with a book containing a list of questions calculated to test his knowledge of London. The questions, which number about 1,500, consist of routes, squares, hospitals, clubs, public buildings, theaters, police and county courts, etc. Not knowing on which particular page he will be examined, the applicant must perforce commit most of the matter to memory if he desires to pass his first application (which does not often happen). Catch questions (such as "Drive me from Westminster Guildhall to Clerkenwell Sessions House," or "Drive me from Broad Sanctuary to North London Sessions House," both of course being precisely the same routes) are often put, and if he fails to answer two out of fifty questions fired at him at railroad speed he is put back for a week to pore anew over the "list of questions." Answers to all may be found, he is told, in the directory.

If he passes the "knowledge of London" test, he receives a "requisition," which is a form filled up by his late employer and two householders in the district where he

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resides, to certify that he is capable, steady, sober, and of good character. The applicant must appear for his license clean and tidy, or the notice curtly tells him that he may be refused. With this requisition he joyfully hies himself to the motor cab company, which hands him over to an instructor to be thoroughly taught the art of driving its cabs, great care being taken to test him in traffic, hill climbing, and the many police regulations. If a fairly smart man, his instructor pronounces him fit after the necessary instruction. He is then sent to Scotland Yard with about seven others, and is taken in hand by an inspector, first to reverse the cab through an archway, an operation in which so many men, though excellent drivers, fail through sheer nervousness. Such little details as looking backwards too often, one side to the other, or momentarily removing both hands from the steering wheel in altering his speed lever on coming out, often fail a man, and the much dreaded "Next man up!" proclaims that he has failed and cannot, unless petitioning the commissioner, enter the test for another fortnight—the second failure means a month's wait. Presuming he is lucky enough to pass the reversing test, the inspector mounts the box and the ordeal of traffic has to be gone through. A favorite route is out of the "Yard," over Westminster bridge, where on the other side one is apt to pass a tram on one's off side, crossing Waterloo bridge, Strand and city. The Mansion House is a particularly tricky center, as even a good driver might pass on the wrong side of one of the many obelisks, as the order of certain streets is not given until almost reached. Trafalgar square and Parliament street are other favorite traps for the novice.

The lucky ones who have passed the driving test give the applicant the friendly "wire" that hand signals, more than moderate use of horn, are noted with satisfaction by the powers that be, and when seeing the gouty old colonel ponderously crossing the road in Clubland, to pull up and exclaim, "All right, sir, no hurry"; or in the city, to an excited old lady, "Take your time, madam! I'll wait!" brings forth from the much dreaded judge, "That's right, my man." Among the 101 things that cause failure and the "Next man up" command are changing speeds noisily, stopping dead between two pavements, thereby causing pedestrians to go round the cab, neglect to give hand signals, remaining too long on tram lines or behind a crawling "growler," accidental stopping of the engine, non-use of horn, remaining longer than necessary on second speed. One man who failed twice was heard to bitterly remark, "A man has to think of about a dozen things and do four of them all at once," which is about true, and knowing that a lynx-eyed inspector is closely watching every movement of hands and feet, a man can be considered fortunate indeed if he succeeds in getting through first time.

After he has passed the driving test and his references are considered good, he is graciously allowed to pay a dollar for his police license and badge, besides the dollar for a motor driver's license, which he must purchase before he even touches the steering wheel. Before receiving the cab, and the pleasant news that he may commence earning money, he receives an instructive lesson on the chassis, so that, in case of a breakdown, if he is fairly intelligent and takes an interest in his work, he can repair or put right any little matter which, however simple, often stops a cab.

The motor cab company then fits him with uniform and accessories, mackintoshes, cleaning coats, etc. He is placed, with a new cab and taximeter complete, on the road, and duly cautioned that politeness and civility cost nothing, and impressed with the fact that wherever he is and whatever time, if the flag of his taximeter is up he is bound to accept any fare.

MOTOR BUS COMPANY QUITS.

RECENTLY the stockholders of the Monroe and Cincinnati Auto Bus Company held a meeting for the purpose of winding up its business. The company had been formed to compete with the Big Four railway for passenger service between Monroe and Cincinnati. It did not take long to realize that the undertaking would not pay, and rather than incur further useless expense it was concluded to wind up the company's affairs.

The collapse of this enterprise furnishes another illustration of the folly of entering upon an undertaking with motors without first having thoroughly analyzed all the attendant conditions. It does not appear that the advice of experienced investigators was sought in this affair, else the service would hardly have been established or so summarily abandoned. The idea is entirely too prevalent that motor buses can be profitably operated everywhere the machines can find a footing. The same thought exists with respect to motor wagon transportation. The truth is, the conditions for mechanical road transport must be favorable if it is to be successful. Competing with fixed transportation of any kind, rail or road, is not the light matter which many ignorant enthusiasts consider it. Intelligent application and skillful administration of the machines will in nearly all cases yield substantial profits. The combination, however, is scarcer than it might be considering how much is known of successful and unsuccessful operation.

The safest policy for investors is to consult with experienced manufacturers of equipment and abide by their decision touching the practicability or impracticability of the projected enterprise. The latter know a great many things which the inexperience of the former denies. They have an instinct for aiding and abetting successful undertakings, and a corresponding distaste for hazardous enterprise.

The Citizens' Automobile Company has been organized in Birmingham, Ala., to operate motor cabs. Its capital stock is $25,000.

A motor bus route between Roswell and Carrizoza, New Mexico, is being surveyed.

The board of fire underwriters in Milwaukee has decided to buy a motor wagon.

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TAXICAB EARNINGS IN NEW YORK.

ALTHOUGH there are four taxicab companies operating in New York, owning over 900 machines, there is traffic for the operation of a much larger number. The company most recently organized is the Taxicab Service Co., incorporated last February. This concern owns 110 cabs and 13 touring machines. To finance the purchase of this equipment the company authorized $1,200,000 common stock and $1,000,000 preferred stock; of the latter $635,000 alone is outstanding. The remaining preferred stock is held in the treasury pending the purchase of further equipment. Since February, quarterly dividends at the rate of 7 per cent and 4 per cent respectively have been paid on the preferred and common stocks.

It was found necessary also to issue bonds to the amount of $77,000, which are secured by fifty cabs and eleven touring cars. Provision is made for their retirement at the rate of $7,000 every three months, principally out of earnings beginning the first of next December, but as $14,000 will be paid through the sale of eleven touring cars, the entire issue will be retired by December, 1911.

A statement of the earnings of the company for the four and a half months from February 15 to July 1, during which it has been in operation, is given as follows:

Gross receipts	$249,850
Operating expenses, including depreciation at 33⅓ per cent	207,219
Net receipts	$42,630
Interest on funded debt	2,082
Surplus	$40,548
Dividends	40,292
Balance	$256

Thirty-four new cabs and eleven touring cars have been bought and will be in operation in a short time. This purchase will be financed through the sale of part of the preferred stock reserved in the treasury.

MOTOR CAB RECEIPTS.

WEEKLY receipts from the traffic of the General Motor Cab Company's machines in London are as follows:

Week ending—	
August 14	$68,976.00
August 21	59,779.20
August 28	59,308.80
September 4	62,996.80

The total receipts from August 1, 1909, to September 4, 1909, amounted to $316,872.

The Motor Transfer Company of Fort Wayne, Ind., has been formed to operate motor cabs.

The chief of the fire department in Washington, D. C., has warmly recommended the installation of motor driven apparatus.

"GETTING THEIRS."

THE anti-taxis met another defeat when Justice Stapleton, of Brooklyn, refused to grant a temporary injunction restraining the New York Taxicab Company from doing a public "hacking" business under its special license. John Hefferon, a public hackman, backed by the allied forces of the meterless, horsepower cabs, applied for the injunction, but Justice Stapleton told him that he was not a proper person to appear in court, suggesting that the city should bring suit to determine the merits of the case.

The public hackmen are grieved because the taxicab folk are violating the provisions of their licenses by accepting business from the general public, whereas their licenses privilege them to take only guests of the hotels and restaurants in front of which they have their stands. The hackmen also wail aloud that the taxicabs have secured possession of all the desirable sites under the provisions of the special license ordinance, which allows them to stand next the curb while the public hackmen are driven to the middle of the street.

The appellate court will be asked to rule on the case.

The ancient, horse-driving cabman doesn't realize that he is an anachronism. He yields slowly his ancient right to charge $4 for taking a young man and the girl before whom he doesn't wish to appear mean, four blocks from a theater to a restaurant, and he looks back regretfully to those good old days when he could stand in front of a restaurant and say insultingly:

"Don't be a cheap skate. Give the lady a ride in a cab."

Really one doesn't care what happens to the public hackmen. They surely used to slam some hot ones into the easy, complacent folk of New York, and no one has much pity to waste on them now that they are getting theirs.—*N. Y. Telegraph.*

CAB COMPANIES MERGED.

THE Taxi Service Company of Boston and the Boston Cab Company have been merged, the former having bought a controlling interest in the latter. H. Bradford Lewis is at the head of the consolidation. The sum of $60,000 will be spent in improving buildings and equipping them. One hundred new machines have been ordered. At present the company operates 69 cabs. Its strongest competitor, the Taxi Motor Cab Company, operates 73 machines and has ordered 100 more for early delivery.

ANOTHER NEW YORK CAB COMPANY.

EVIDENTLY professional sentiment is not unanimous in New York concerning the profit derivable from motor cab enterprise. The incorporation of the Allen Taxicab Company, with capital stock of $1,000,000, would seem to imply that the business is not so demoralized as those already intrenched in power have sought to make out.

Eight motor cabs are operating in Pasadena, Cal.

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CHICAGO'S TUNNEL TRANSPORTATION.

EVEN the security holders of the Chicago freight tunnel enterprise think lightly of it. Its stock is now quoted at 11, having fallen off 5 points in the past few weeks. Recently the stock has come on the market in such large amounts as to indicate the liquidation of some important holding.

J. Ogden Armour and E. H. Harriman became the principal owners of the stock and assumed control of the tunnels when the old Illinois Tunnel Company, the operating concern, was taken over by the Chicago Subway. Mr. Armour and Mr. Harriman advanced money for years to make up the difference between the earnings of the company and the interest on the bonds. It becomes a question now whether Mr. Armour, since Mr. Harriman's death, will assume that burden alone. It is not considered probable that the Harriman estate will continue to advance any part of the money. Mr. Armour has not made any announcement of his intention in that regard.

Part of the decline in the price of the stock has been due to fear that the Harriman interest in the company would come into the open market. That does not appear probable. It is believed that the Harriman holdings will be disposed of at private sale, if at all, and in view of Mr. Armour's present large interest it is not unreasonable to think that he will concern himself with the placing of the stock.

The business of the Subway company is said to be improving. Its earnings are still far short of its interest charges, however. On $17,000,000 of 5 per cent tunnel bonds in the hands of the public and a 6 per cent loan of $9,500,000, the company's interest charges are about $1,420,000 a year. The earnings reported by the company last year were $311,996, the largest amount it ever reported. The company recently ordered 1,000 additional cars and 50 motors to handle its increasing traffic.

NEW WANAMAKER GARAGE.

THE commercial motor vehicle equipment of the Wanamaker dry goods establishment in Philadelphia is now so extensive, and is soon likely to be so heavily augmented, that the erection of a garage has become necessary. Recently the firm took a five year lease on the building formerly occupied by a foundry at the junction of 25th street and 11th avenue, covering a piece of ground 125 by 100 feet. Extensive alterations will be made in the building, and it will be equipped for the maintenance of the delivery machines used by the Wanamaker store. The aggregate rental is $30,000.

The Elizabeth (N. J.) Taxicab Company has been formed with capital stock of $100,000.

The Evansville (Ind.) Taxicab Company has been organized with capital stock of $10,000.

Money is being raised by popular subscription in order to purchase a motor hose and chemical wagon for Manchester, N. H.

COMMERCIAL MOTORS IN GERMANY.

ON the first day of the present year there were 2,252 commercial motor vehicles in service in Germany. A year prior to that there were 1,778 in commission, while at the same time two years ago there were 1,211 registered. The distribution of these machines at the periods mentioned was as follows:

Motor Wagons and Trucks.

	1907	1908	1909
8 h. p. or less	500	794	986
8 to 16 h. p.	291	381	458
16 to 40 h. p.	98	221	371
40 h. p. and over	1	3	4
Total	890	1,399	1,819

Machines in Official Service.

	1907	1908	1909
8 h. p. or less	11	22	34
8 to 16 h. p.	18	28	33
16 to 40 h. p.	16	49	58
40 h. p. and over	..	12	12
Total	45	111	137

Motor Buses and Cabs.

	1907	1908	1909
Up to 8 h. p.	319	501	675
8 to 16 h. p.	735	1,003	1,348
16 to 40 h. p.	141	230	317
40 h. p. or more	2	...	...
Total	1,197	1,734	2,340

Motor Cabs and Buses in Berlin.

	1907	1908	1909
Up to 8 h. p.	174	186	239
8 to 16 h. p.	340	364	497
16 to 40 h. p.	51	103	135
40 h. p. and over	...	...	...
Total	565	653	871

Motor Wagons and Trucks in Berlin.

	1907	1908	1909
Up to 8 h. p.	231	337	372
8 to 16 h. p.	62	82	95
16 to 40 h. p.	5	20	30
40 h. p. and over	...	...	...
Total	298	439	497

COMMERCIAL MOTORS IN FRANCE.

GOVERNMENTAL statistics show that in 1899 there were 234 industrial motor vehicles in France. In 1900 there were 543; in 1902, 1,849; in 1903, 3,062; in 1904, 4,588; in 1905, 6,532; in 1906, 8,904; in 1907, 11,685; and, in 1908, 15,334. In the last three years there has, therefore, been an increase of 8,802 vehicles. It is interesting to note that in the same period there was only an increase of 7,241 pleasure cars.

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Police wagon used in Indianapolis equipped with K. H. spring wheels.

Spring Wheel Design

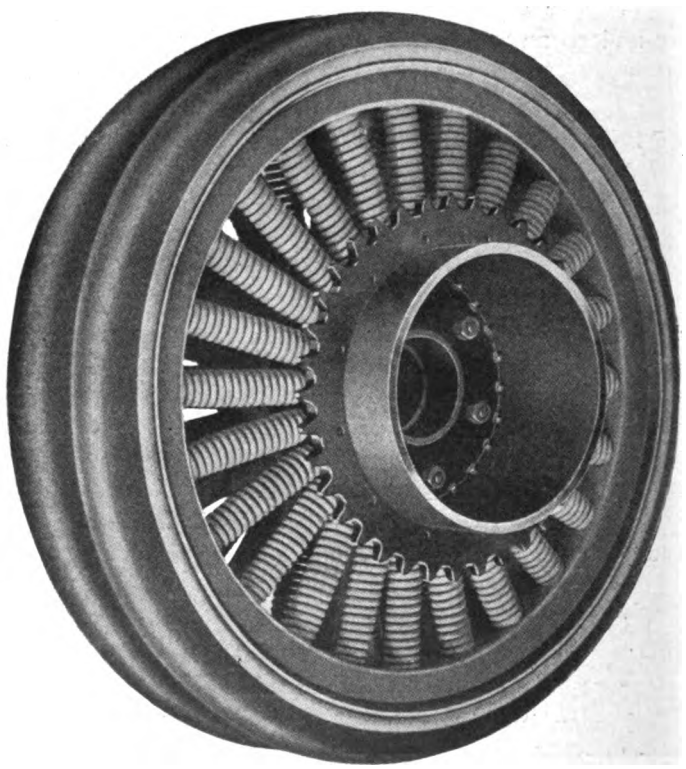
Torque is applied gradually, relieving tires and driving mechanism of stress.

SPRING wheels have been so frequently condemned on account of obvious defects that the mass of vehicle owners have come near despairing of ever seeing a design which would prove acceptable to automobile engineers. The K. H. model, however, appeals to the critics of such construction. With it the power, instead of being applied to the tread of the tire through a fixed or solid wheel, is gradually transmitted through flexible springs, causing the tire to adhere to the pavement instead of revolving before it "bites." The tendency of this is to reduce wear on the tread and to eliminate the pounding which causes a tire to work loose at the base. These flexible springs permit the torque to be applied gradually, thus relieving the driving mechanism from sudden shock.

The K. H. Wheel Company makes this product in Detroit. Its efforts to market the design are backed by one of the largest automobile wheel making concerns in the country.

Obviously the springs, which take the torque and carry the load, represent the most important feature of the construction. After trying various kinds of steels without success it became necessary to develop a special alloy and heat treating process. When this was done it was found that a set of springs, in a specially devised testing machine, would yield service equivalent to 60,000 miles of road work.

The spokes, felloe and rim of this wheel are constructed substantially the same as the standard artillery automobile wheel, but the hole in the center of the wheel is made much larger and the spokes are assembled in a ring of U section instead of the hub. The hub, which is similar to any artillery hub, has the inside flange cast integral with it. Extending laterally from this flange is a circular flange (E). The flange (F), which is also cast integral with the hub, is of such diameter that it will pass through the hole (A) in the center of the wheel. After placing the hub in position, by passing the small flange (F) through the hole (A), the outside flange (G), which has the lateral circular flange (H), is bolted on. The springs are then placed in position, and the hub ends attached to the flanges (E and H) and the outer ends to the



Rear K. H. spring wheel for five-ton truck.

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felloe. After the wheel is placed on the car the hub cap (I), having the dust flange (J), is screwed to the hub. It will be noted that there is an annular space (K) between the hub and the ring (B) on the inner end of the spoke.

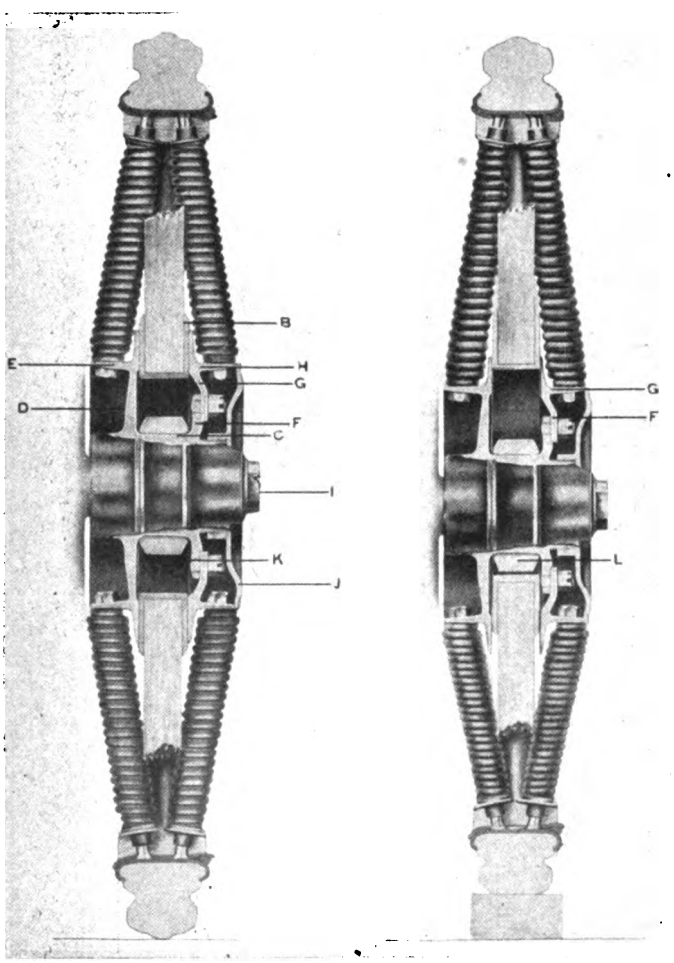
When the wheel meets an obstruction the center slides between the hub flanges. This permits the axle to remain horizontal instead of elevating it.

The vibration so noticeable on motor trucks having solid wheels and tires is practically eliminated when the machines are fitted with these wheels. In addition to this, heavy machines so equipped yield three to four times the tire mileage afforded by regular wheel equipment.

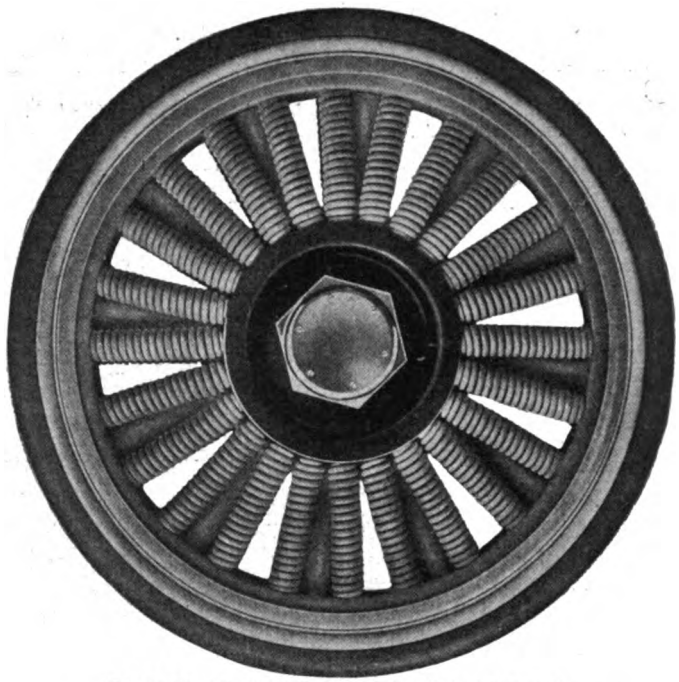
Arrangements are being made to establish motor bus service between St. Clairsville and Lansing, W. Va. The service will be conducted by the people who are now operating a motor bus line between Harrisburg, Mt. Pleasant and Wheeling.

On recommendation of the fire chief the Toronto council has decided to purchase motor fire apparatus.

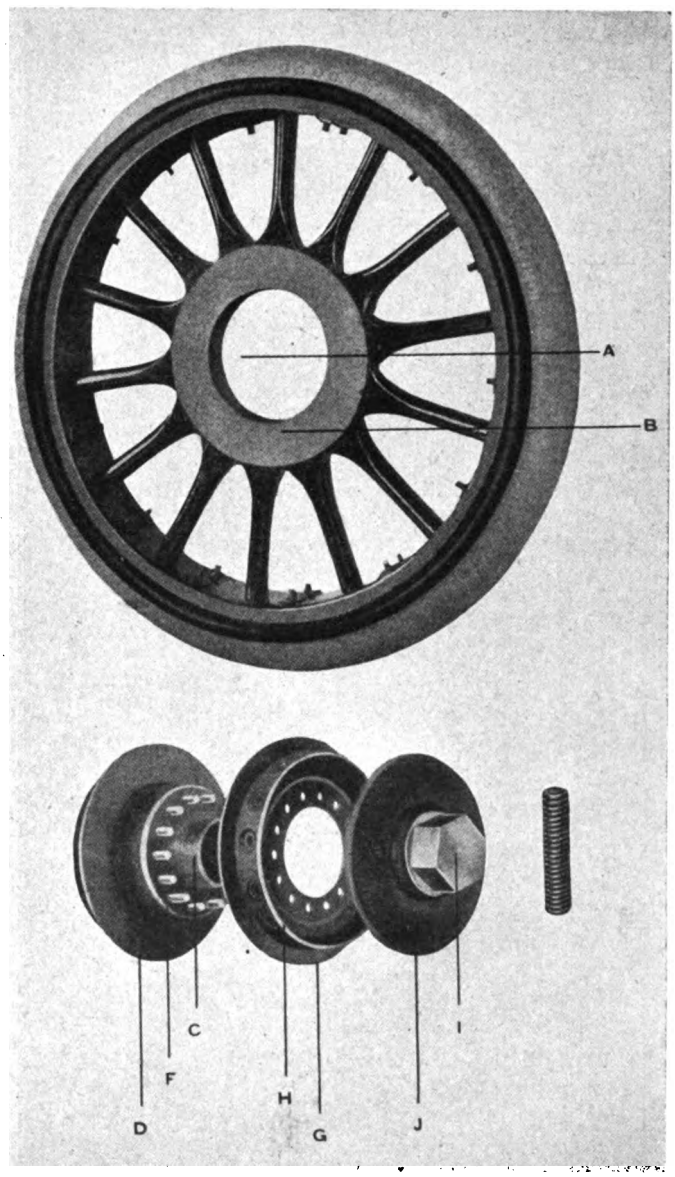
An American firm has supplied the marine hospital of Brazil with its third motor ambulance. Two machines were imported from France.



Position of hub when K. H. spring wheel is on level surface and when passing over an obstruction.



Front K. H. spring wheel for five-ton truck.



Assembly of K. H. spring wheel.

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POSTAL EXPERIMENTS.

SATISFACTORY experiments in motor mail collection were recently conducted in Kansas City, Kan. Two collection routes, comprising 150 letter boxes, were combined into one and the mail collected by a gasoline machine. Usually it takes two men and two horses seven hours and twenty minutes to make the collection, but it was made in two hours and forty minutes by motor. Approximately 35 miles were covered and 150 stops made.

The test was made at the request of C. P. Granfield, first assistant postmaster general, who is desirous of establishing either motor car or motor cycle collection service in cities like Kansas City.

Another experiment of like character was conducted in the downtown district of Los Angeles with an electric truck. In this case the postmaster secured the biggest machine he could find, and equipped it with cages, pigeonholes, etc. Four clerks were assigned to it. Mail was deposited on the counters of the machine, and quickly assorted. Postmen who make collections from boxes in office buildings met the rolling postoffice at certain points and delivered their burdens. The machine connected with all outgoing trains, and letters were started for their destinations with small loss of time. The experiment worked wonderfully well. It lasted for one week.

The New York Taxicab Company at present operates 500 French machines which cost $2,250 apiece. This equipment is being increased at the rate of 10 a week until it will eventually possess 700 machines.

RURAL POSTAL MACHINES.

A WESTERN senator proposes that Congress shall appoint a board of experts to design a motor wagon for rural mail use. He will ask that the type so evolved shall become the exclusive property of the government. The machines are to be supplied without cost to the carriers who, it is expected, will not object to a reduction in pay if they are permitted to escape present horse wagon expense. Betterment of the rural mail service is to be urged as the government's excuse for the outlay.

MOTOR MAIL COLLECTION IN PHILADELPHIA.

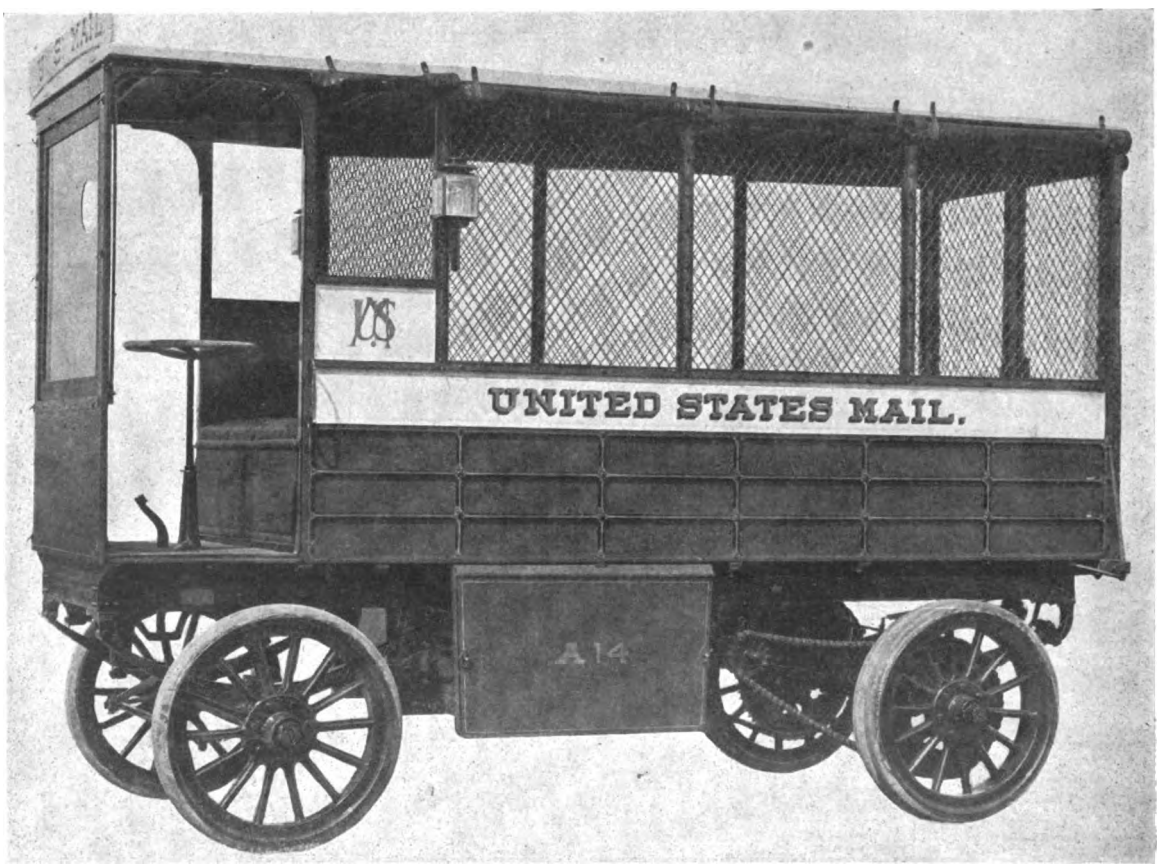
FIVE machines will be placed in mail collection service in Philadelphia on October 1. They will come from the Autocar factory at Ardmore, Pa. The Washington authorities have given sanction for the installation. The territory to be covered by the machines will be below Pine, above Race and west of Broad street.

A negress drives a motor cab in Paris.

The Norfolk (Va.) Taxicab Company will commence operations on October 1.

Motor bus service is being supplied between Dayton and Xenia, Ohio.

The Auto Transportation Company has been formed in Covington, Ky., with capital stock of $3,000.



One of 14 electric wagons employed by Motor Delivery Company in mail collection in New York City.

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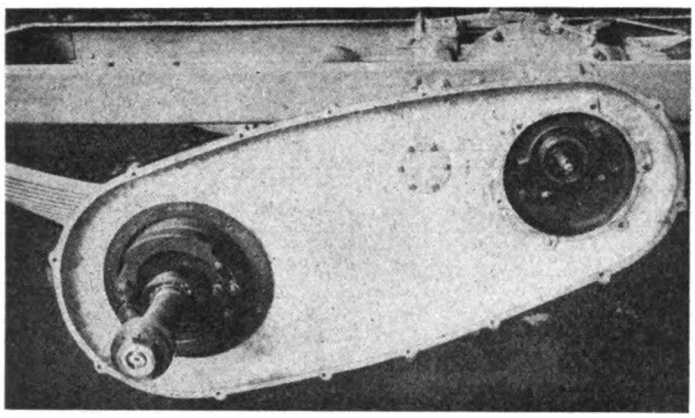
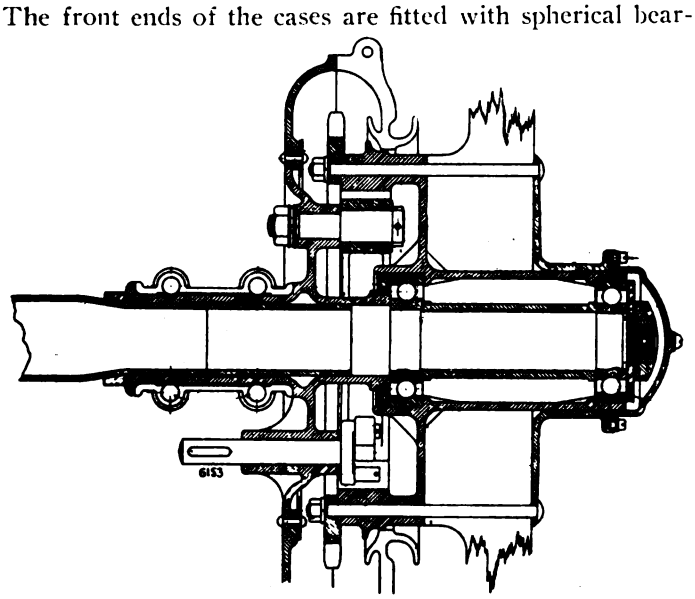
CHAIN CASE DESIGN.

ONE of the principal features of design in a 3,000 pound gasoline wagon which has just made its appearance abroad is an aluminum chain guard constructed in the following manner: Each spring bed on the back axle is provided with a large cast-steel flange, and to this flange the back half of a chain case is riveted. A steel



Chain case with front cover removed.

ring is also fitted in order to protect the aluminum casting from damage by the rivet heads. The front portion of the chain case is made in two halves so as to facilitate its assembling. The flanges on the spring-bed brackets also carry the fulcrums of the back-wheel brakes, and each case, therefore, acts both as torque bar and radius rod. The front ends of the cases are fitted with spherical bear-



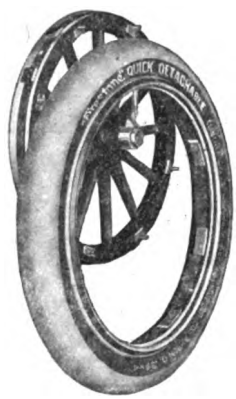
Section through rear wheel hub showing method of fixing chain case.

ings in order to allow of the independent lifting of either wheel, and also of the rolling of the chassis, without in any way distressing the gearcase. For this reason also, one of the spring beds is free to rotate on the axle while the other one is securely clamped thereto.

Provision for adjustment of the chains is made by the fitting of eccentrics which may be actuated by the handles in the gearbox. The chains are made up entirely by riveting and are not provided with the usual chain bolts—in other words, they are endless. These riveted chains have entirely overcome the objection which has been urged against gearcases in the past.

DEMOUNTABLE RIMS FOR CAB WHEELS.

FIRESTONE demountable rim equipment includes a rim fitted to each wheel and an extra rim carried as a spare, equipped with an inflated tire. When on the road a cab driver may instantly remove a damaged tire and its rim, substitute the spare rim with its already inflated tire, and resume his journey without further interruption. The deflated tire may then be attended to at the journey's end. Firestone demountable rims do away with delays from tire trouble. There is no annoying exertion; no prying off damaged tires from their rims and then forcing them



on again; no tire pumping on the road. The temptation to run the tires deflated for even a short distance, and so damage them, is removed.

These demountable rims are adaptable to all quick detachable and clincher tires. They may be fitted without changing the present tire equipment in any way. The parts are made in such away that they cannot stick fast from rust or road accumulations. All angles of contact are so blunt that wedging of parts is impossible. There are no thin, narrow wedge shapes, no complicated parts. No special tool is required.

For $75 a month the police department of Joplin, Mo., is to be supplied with the service of a motor patrol wagon.

There are now less than 1,000 horse drawn buses in London. Four years ago there were 3,551 of these ancient vehicles.

Traffic receipts from motor bus service in Berlin are increasing, while operating expenses are decreasing. More machines are being purchased by the company which has control of the business.

The Taxicab Company of Cleveland, Ohio, has been organized with capital stock of $10,000.

The authorities of Omaha have decided to postpone the outlay of $100,000 for the purchase of new horse drawn fire apparatus and erection of new engine houses until an investigation of the advantages claimed for motors has taken place.

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AN EASTERN MOTOR CHEMICAL WAGON.

LATE in July the Pope Manufacturing Company delivered a motor hose and chemical wagon to the fire department of Westfield, Mass. The engine develops 40 hp. and is geared for speed as desired up to 40 miles per hour. The wheel base is 120 inches and the tires are 34 by 5 inches. The fire fighting equipment consist of a 40-gallon chemical tank with extra jar and holder and connection for 2½ inch water hose, 250 feet of ¾ inch hose, 1,000 feet of 2½ inch hose, one 17 foot scaling ladder, two 3-gallon hand extinguishers, two pickhead fire axes, four fireman's lanterns and one door jimmy.

STANDARDIZING MILITARY MACHINES.

GERMAN manufacturers are co-operating with the war authorities in the standardization of certain features of military machines. Hereafter all four-ton trucks will be equipped with rims of 670 millimeters diameter in front and 850 in the rear. The width of the front tires will be 120 millimeters, while the rear ones will be of double construction, of a total width of 140 millimeters. The outer diameters of the front and rear members will be, respectively, 830 and 1,030 millimeters. Slot fastening of tires to rims has also been adopted.

A motor patrol and ambulance will be purchased for the police department of St. Joseph, Mo.

The sum of $2,700 has been appropriated for the purchase of a second motor ambulance for the city hospital of Newark, N. J.

Motor cab service is to be supplied in St. Joseph, Mo.

Coffeyville, Kan., is to be provided with the service of motor cabs.

The Little Rock (Ark.) Taxicab and Transfer Company has been organized with capital stock of $20,000.

DISPUTE OVER INSURANCE.

PROBABLY the majority of commercial motor vehicle owners carry insurance on the machines. But do their policies afford protection against loss by fire resulting from collision or accident? This is a point which is often overlooked by the insured, and as it is not at all unlikely that a wrecked machine will catch fire it is well to guard against the complete disaster which such a catastrophe threatens.

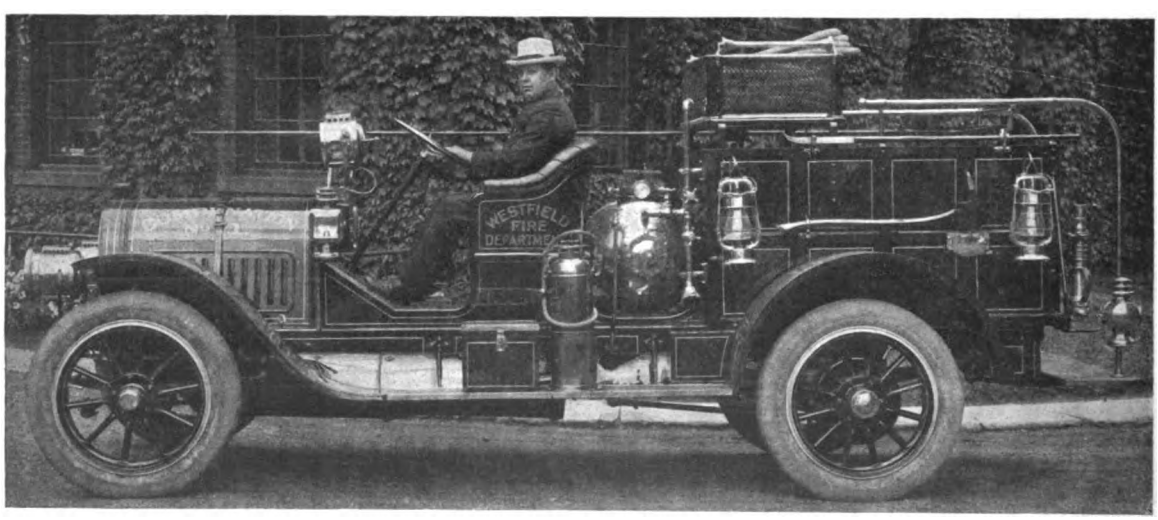
To give point to the different opinions concerning responsibility which may be entertained by the buyers and the sellers of insurance take the case of a Fall River, Mass., owner whose machine left the road, crashed through a fence, struck a tree, overturned, caught fire, and was totally destroyed. The vehicle was insured in the Automobile Insurance Company of America, located in Providence, for $3,800. A claim for $2,700 was made. The company disputed it, raising the point that the policy did not cover damage by fire, and that most of the damage was so caused, the loss due to collision being much less than the amount of the claim. A clause in the policy provides that in case of dispute over a claim the matter shall be referred to three inside parties, to be mutually appointed, who are to nominate the damages and adjust the claim. A clear understanding on this important matter would be of great advantage to the insured at the time of issuing the policy.

The purchase of a $4,500 motor hose and chemical wagon has been recommended for use in Wilkes-Barre, Pa.

The municipal authorities of Dallas, Tex., have decided to make use of a motor ambulance which will be furnished by a contractor for $100 a month.

Deliveries to branches from the public library at Indianapolis will soon be made by motor wagon.

Mechanically propelled vehicles will be sent from Spain for use in the Moroccan campaign.



Motor hose and chemical wagon installed in fire department service at Westfield, Mass.

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WILL MAKE GOPHER TRUCKS.

THE Robinson-Loomis Motor Truck Company has been organized in Minneapolis with capital stock of $50,000. The president and general superintendent of the concern is T. F. Robinson, who for several years past has been engaged in the sale of commercial motor vehicles. The treasurer of the organization is F. L. Loomis, who was formerly sales manager of the Reliance Motor Truck Company. Machines with rating from two to five tons will be manufactured. The lighter machine will be equipped with a two-cylinder 22 hp. engine and the heavier model with a 30 hp. engine. Transmission will be of the selective gear type. Final drive will be accomplished by means of side chains.

TO MAKE MACHINES IN OSHKOSH.

THE Badger Auto Company, of Oshkosh, Wis., has been organized with capital stock of $50,000 for the production of motor trucks. The machines will be made in the buildings of the Termatt & Monahan Manufacturing Company, which concern has been absorbed by the new company.

ANOTHER TRUCK COMPANY ORGANIZED.

GASOLINE machines of one, two and three ton capacity will be made by the United States Motor Truck Company, a concern which was recently organized in Cincinnati with capital stock of $100,000. At present the company is seeking a site for a factory. The incorporators are Harry L. Manss, Alfred Hill, H. B. Mackey, Jesse Lowman and Herman Erdman.

BUGGY COMPANY TO MAKE MACHINES.

THE Middletown Buggy Company, of Middletown, Ohio, has announced its intention to manufacture motor wagons. The company is now engaged in the construction of two models, one of which is a light delivery wagon equipped with 15 hp. engine, and the other a vehicle of higher rating equipped with a 30 hp. engine.

Unless the House of Lords rejects the new British finance measure in its entirety it is certain that the proposed tax on gasoline will press heavily on the owners of commercial motor vehicles. It is said that one firm of motor mail contractors will, if its fuel is taxed, lose to the extent of $2,900 annually unless the government grants exemption to such concerns.

GRAMM-LOGAN INCREASES CAPITAL.

AT A recent meeting of the stockholders of the Gramm-Logan Motor Car Company it was decided to increase the capital stock from $100,000 to $200,000. A substantial dividend was declared and a considerable sum passed to reserve. During the past year the plant has been liberally equipped. The following officers were elected: A. L. White, president; B. A. Gramm, vice-president and general manager; F. E. Lamb, secretary; J. B. Wilson, treasurer; W. T. Agerter, M. Cokely, R. W. McMahan, W. M. Tuller and J. E. Parks.

RANIER TO SELL TRUCKS.

THE Ranier Motor Truck Company, of New York City, has been incorporated with capital stock of $50,000 to sell machines in the eastern states. Models supplied by the Reliance Motor Truck Company will be sold under a five years' maintenance agreement. The firm will principally operate in New York, Philadelphia and Boston. A large garage for the convenience of the New York business will be erected and equipped at once.

TO MAKE MACHINES IN SPOKANE, WASH.

THE Spokane Motor Car Company, of Spokane, Wash., has been organized with a capital stock of $600,000, to manufacture a four wheel drive truck. The following officers have been chosen: President, V. E. Funkhouser; vice-president, Edward Schulmerich; secretary, F. M. Skiff; treasurer, A. L. MacLeod; general manager, Thomas Bilyeu. Models varying in capacity from 1½ to 7 tons will be manufactured.

AXLE COMPANY TO MAKE WAGONS.

THE Sheldon Axle Company, of Wilkes-Barre, Pa., is building a factory for the construction of commercial motor vehicles. The company is not yet ready to announce the design details of the machines which it will make.

Unofficial instructions have been given to the postmaster at Indianapolis to keep motor wagons permanently at work in the collection of mail. At present there are four machines in such service.

The sum of $4,000 has been appropriated for the purchase of a motor hose and chemical wagon for Lockport, N. Y.

The most Prominent Makers of Electric Vehicles all use The "Exide" Battery
Get our RENEWAL proposition—it's attractive.
Buy What the Experts Buy
THE ELECTRIC STORAGE BATTERY CO. 1888 1909
NEW YORK BOSTON CHICAGO ST. LOUIS PHILADELPHIA, PA. CLEVELAND ATLANTA SAN FRANCISCO TORONTO

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FIRESTONE COMPANY'S ELECTION.

AT THE regular meeting of the Firestone Tire & Rubber Company the following officers were elected: H. S. Firestone, president and general manager; Will Christy, vice-president; S. G. Carkhuff, secretary; L. E. Sisler, treasurer. The annual report showed an increase in sales of about 50 per cent over the previous fiscal year. In order to keep pace with sales the company is planning to erect an immense tire plant on 15 acres of land purchased a short time ago for that purpose.

BAKER COMPANY'S NEW CHICAGO BUILDING.

WHEN completed next May the Baker Motor Vehicle Company's new building in Chicago will be the finest electric garage in the United States. A two-story brick building is being erected on a 50 by 150 foot property on Michigan avenue. To secure these quarters a large cash outlay was necessary, the lease of ten years calling for a rental of $25,000 per year for the first five years and $27,500 per year for the next five. The new building will be equipped with many features that will give it extraordinary distinction among garages.

NEW PLANT FOR STERNBERG COMPANY.

CONTRACTS have been awarded for the erection of a factory measuring 200 by 350 feet in which the Sternberg Manufacturing Company, of Milwaukee, will produce commercial motor vehicles. The site of the new building is located at West Allis. Its equipment will enable the company to make 200 machines a year.

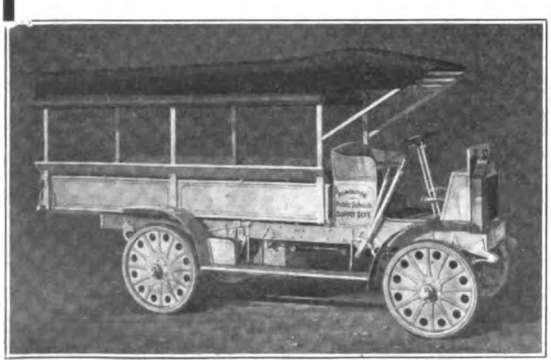
TO INCREASE FRAYER-MILLER OUTPUT.

THE new building which the Oscar Lear Automobile Company recently erected is about ready for occupancy. Its machinery equipment will enable the company to double its output.

In France two distinct opinions are entertained concerning cab engine design. One favors the employment of single and two-cylinder motors, while the other upholds the use of the small four-cylinder motor. The latter type is said to cause less expense for mechanical upkeep and occasion minimum wear on tires.

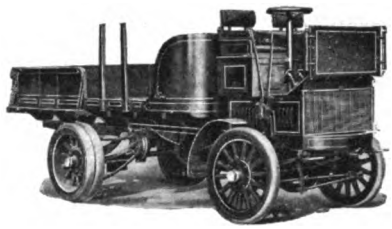
ALWAYS GOING

Don't Buy A Truck Until You Have Investigated Our Line



We make two sizes:
2000 to 3000 pounds,
4000 to 7000 pounds.

THE Sternberg Mfg. Co.
Milwaukee, Wis.

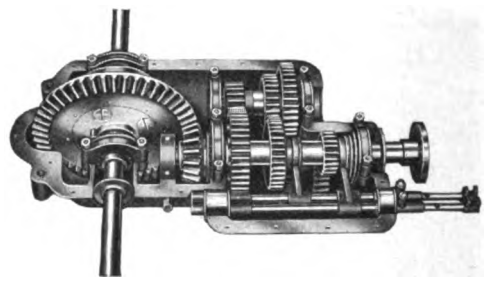


KNOX MODEL 15
4-Cylinder, 3-Ton Truck
Price $4,300

ALL TYPES OF

KNOX Commercial Cars

As well as the mechanism are designed to best mee the demands and requirements they must endure in commercial service.



Knox Commercial Change Speed Gear Set

The transmission, as well as all other parts, has been designed especially to meet the added strains of heavy work. The gear set is of the selective type, three speeds forward, one reverse. Gears are made of large size (see cut) from chrome nickel steel. The bearings are Timken roller of extra large size, as are all shafts, etc.

MR. DEALER: *Our commercial line is a good asset, and a valuable addition to your business. Write us for catalogue and information.*

Knox Automobile Co.
SPRINGFIELD, MASS.
Member A. L. A. M.

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The Power Wagon

A Journal for Those Employing Commercial Motor Vehicles

No. 60 NOVEMBER, 1909 No. 60

PUBLISHED THE FIRST OF EVERY MONTH BY

THE POWER WAGON PUBLISHING CO.

SUBSCRIPTION RATES:

One Year (Domestic)	$2.00
One Year (Foreign)	3.00
Single Copies	.20

PUBLICATION OFFICES:
THE METROPOLITAN BLOCK
Chicago, Illinois.

Advertising Rates on Application

WALTER WARDROP, Editor

Entered as Second-Class Matter December 2, 1907, at the Postoffice at Chicago, Ill., Under the Act of Congress on March 3, 1879.

Expert Aid for Buyers

Work of the consulting expert is of great value to concerns contemplating heavy investment.

AN alert and prudent buyer of commercial motor vehicles can ill afford to ignore the professional adviser whose experience entitles him to rank as a road transportation expert. At the present moment there are not many men whose knowledge of all matters affecting investment, operation and maintenance of mechanical equipment is supported by a like familiarity with the conditions attending horse haulage. Those who possess this twin endowment are very properly designated expert road transportation engineers, and their influence is co-extensive with their ability.

* * *

One does not encounter these well informed people at every conference held for the purpose of considering the installation of power wagons. There are not enough of them for that. Such examples of their remarkably skillful work as are occasionally circulated in private often reveal information which it is of the highest importance to know before any action can be intelligently formulated. Documents which exhaustively detail the cost of operating draft animals and motors, accurate charts of service for both forms of equipment, analytical studies of special performance, scrupulous accounting, flat comparisons of investment and maintenance, sharp contrasts of tonnage and mileage, tables of efficiency, diagrams of horse and machine routes, suggestions which it is well to heed and alternative methods which may be successfully employed, and sound advice bearing upon the relation of machine ratings to service—the preparation of these indispensable materials comprise the work of the expert consulting engineer and may be said to constitute the science of investigation.

* * *

We have often had the privilege of inspecting such reports, which were only obtained after much painstaking effort on the part of the investigating expert and his corps of assistants. They are, without any exception, the most illuminating studies extant upon the subject of motor wagon transportation. The numerous installations which have proceeded from such investigations attest their value.

It is to be understood, of course, that work of this character is chiefly accomplished for such establishments as are heavily engaged in transportation. Its main purpose is to demonstrate the great economy which follows a total supersession of horses. By sketching the details of a recent investigation it will be observed how strong is the inducement to undertake mass conversion of equipment.

* * *

A well known firm, employing about 60 two and three-horse wagons in one of its eastern distributing depots, being anxious to know if its local haulage could be accomplished more economically by motors than by draft animals, decided to let a transportation expert decide the issue. For a month the investigation was in progress. When it was ended the firm was told that 40 mechanical units of 3½ and 5 ton rating would perform the work of the horse equipment. It was also demonstrated that, from the sale of the horse equipment and the saving to be derived from the employment of the motors, the investment in the latter could be retired within two years, and that thereafter the machines would pay 7 per cent annually on a capitalization almost three times as large as that represented by their original cost.

The concern to which this temptation was offered, instead of siezing the opportunity to save $18,000 a year or so by an exchange of administrative method, merely bought three or four machines, doubtless expecting to realize an economy in their operation proportionate to that set forth in the expert's report. It will inevitably be disappointed in this hope, for none of the scientific practices conceived by the investigating engineer are employed. The

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success of the mechanical units, while by no means problematical, is not likely to be as brilliant as if they were the preponderating feature of equipment.

* * *

One who has had much experience in this class of work writes in the following manner of the difficulties which beset the consulting expert, who is sometimes a free agent and at other times the unprejudiced representative of a vehicle producing concern:

"I have personal knowledge of a case where a transportation engineer advised a prospective purchaser against the installation of motor wagons. Here the superior knowledge of the underlying principles of commercial motor vehicle transportation which the engineer possessed, and the importance of detailed consideration, was exerted against his customer, and apparently against the interests of his employer. Yet when we come to analyze the conditions under which his judgment was formed, and to consider subsequent events, the value of his decision to his own company—even considering the monetary loss—is apparent.

"In this particular case the purchase of an electric vehicle installation approximating $50,000, was contemplated. The prospective customer habitually ran his entire business under such advanced methods that every detail of operation in each department was recorded, and consequently he was able to furnish the engineer complete data on the cost and operation of his transportation system. The figures presented were considered in detail, and the engineer reported that, owing to the peculiar characteristics of the service, no dcrease in the total number of vehicles operated could be effected, and no appreciable saving in time or increase in territory would result. In other words, the substitution of automobiles for horses meant the installation of vehicle for vehicle, the load conditions precluding the efficient operation of the automobile. No sane automobile man will contend that one machine can be operated as cheaply as one one-horse wagon. It is of interest to add that several competitive companies afterwards demonstrated the accuracy of the engineer's figures.

* * *

"It is the recognition of this engineering feature, more than anything else, that will tend to hasten the general introduction of automobiles into commercial service. At present the engineer encounters his greatest obstacles in the very persons whom he wishes to benefit. I have had horse operators—that is, superintendents and stable bosses—say, 'I have been handling this business now for twenty years, and no outsider can come in and show me anything about running it,' while a glance around the shipping room showed a congestion which might be eliminated by the exercise of a little thought and less contentment on the part of the traffic superintendent simply to get the work out, and to remain in his highly remunerative position for twenty years at a salary of $1,500.

* * *

"Again, the engineer is confronted by the man who wants to be shown, who says, 'I'm from Missouri,' but still does not know what he wants to be shown. He demands an expensive 'demonstration,' evidently believing the motor wagon to be a haphazard contraption designed to fool the buyer, and that the matured production of the sound brains and capital of such large organizations as are responsible for the development of our street railways, lighting, and power plants, must accept final judgment from him before its practicability is assured. And then after a demonstration he knows only that work was performed, and that is all. He doesn't know whether the vehicle was operated at its highest efficiency (which in itself is impossible, owing to the impracticability of interfering with the general routine of daily work), nor does he know what the cost of operation has been.

* * *

"Again, others consider the question of mileage of first importance. This is especially true of the electric vehicle 'prospect' who confronts the engineer with the question, 'How many miles will the vehicle go on one charge?' The idiocy of this question is apparent when one considers that mileage performance is governed entirely by the individual characteristics of the routes and nature of the business, and is not a matter of capability on the part of the vehicle, but of possibility. This is also true of speed, although here the elements of safety and of economy play an important part.

"These conditions are now being met by the engineer, who looks at the matter from an entirely different viewpoint. In his case the automobile is the last subject for consideration. With his analytical mind, he looks upon the prospect as a unit of daily work to be accomplished by a segregated power plant whose operation is controlled by road and traffic conditions, speed, territorial characteristics, and human idiosyncrasies, all of which are properly analyzed and weighed when the final selection and operating methods of the vehicle are determined.

* * *

"It is often found necessary to operate an automobile in actual service in order to collect adequate data for the intelligent recommendation of the type and size of vehicles, motive power, equipment, gear ratios, territorial limits, and general operating conditions. This data may generally be obtained from averaging conditions after several trips over the same routes. Later—as the trips must generally be taken over existing horse routes to prevent interruption of business—the automobile work performance may be deducted, and the total number of vehicles, territorial lines, etc., determined. A final analytical report is then submitted, showing comparative costs of operation by the automobile and horse methods for the same performance, and when the transition is made the engineer superintends the installation and details of operation.

"All this takes time and money. But the results obtained warrant the expenditure. A stable installation of automobiles is assured, standing forever as a monument to the company courageous enough to ignore the whims of its customers and insist upon a recognition of the scientific elements of autobobile transportation."

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To New Readers

Don't be disappointed if this particular issue should fail to supply the precise information you may require.

The economy of motor road transport is so varied in character that it is practically impossible to give more than a few examples of its manifestations in any one number of this journal.

Constant reading of the "Power Wagon" will abundantly reward those who are not in too great haste to learn everything connected with the important industry which it serves.

Much of our work is broadly educative, rather than sharply definitive. But in every issue we release enough information to demonstrate that in some selected service the machine is far superior to the horse as a transportation agent.

We do not advocate the exclusive use of any one type of vehicle. Each has its place in commerce, which is retained by special merit.

From the mass of information, published and unpublished, which we have secured to prove the value of motors in commercial service we will gladly make such selection as will be useful to intending purchasers.

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MOTOR AMBULANCES WANTED.

REFORM in municipal service methods is often occasioned by some calamitous circumstance which is traceable to official negligence. For years the extraordinary advantage of the motor ambulance as an auxiliary to police service has been plainly apparent to all who take a decent interest in the practice of the humanities. Its adoption, however, rests with the constituted authorities, and it is unfortunate that they are so material as to consider cost and work economy of more importance than the splendid service the machine is capable of rendering. But, happily, organs of public opinion and chief magistrates are giving the subject some attention, being spurred to action in many instances by the occurrence of fatalities for which the retention of the inadequate horse-drawn ambulance is largely to blame. Thus in Cleveland, Ohio, the press and mayor are tardily urging a reform which the exercise of clear reason might have anticipated. Both cry loudly for the installation of motor ambulances. One of the local papers says:

It is high time for reform in the ambulance conditions of this great city of six hundred thousand people.

The community has been suddenly awakened to its responsibility by the death of a child. This boy, run down by a locomotive at W. 58th street, was carried by a switch engine to the union station, where he lay until the arrival of a horse-driven, privately-owned ambulance, which had come all the way from E. 70th street and Superior avenue. Then he was carried back to an East-end hospital three miles from the union station. There he died from loss of blood.

Eight hospitals were nearer, but the railway company, BY CONTRACT, had provided months before this boy was injured that he should be carried by this particular ambulance to this particular hospital.

This story is a frightful indictment against us who permit such conditions to exist.

To our credit, the city administration has taken steps to end the evil. It proposes to turn ambulance calls over to the police department, which is to direct the nearest ambulance to carry the injured to the nearest hospital.

This plan is better than the one we are working on now, but it does not go far enough. Mayor Tom is right when he says:

"I advocate the placing of automobile ambulances in the fire stations. These should be subject to call at any time. Those injured should be taken to the nearest hospital. If an ordinance is introduced providing for this I shall give it my approval. I will do what I can to bring about its passage."

The city's 1910 budget must provide for a modern and complete municipal ambulance system. Past budgets have been able to equip various city departments with automobiles, and only recently a big touring car was bought for the police service. We have money enough to care for the injured and dying.

Council should waste no time in making an investigation of the city's needs, and in establishing forthwith in Cleveland the best ambulance system in the world.

The chief of police declares that four motor ambulances will be enough to take care of the emergency demands of the city. The city solicitor is drawing up an ordinance providing for the installation of the machines, which will be under the control of the police department. Twelve applications have been received for positions as drivers of the machines, all the candidates having successfully passed oral and written examinations for competency.

SCAVENGING MOTORS.

MOTOR scavenging wagons will soon be installed in Vancouver, B. C. The city council has learned that one of these machines, with a crew of eight refuse collectors and two drivers, can accomplish as much work as five horse-drawn carts of the type now commonly used. The cost of such a machine is $8,000, if imported, and its maintenance is slightly more than $4,000 a year. In determining the maintenance charge drivers are rated at $85 a month, collectors at $60 a month, and supplies and repairs at $312. For horse equipment to do a similar amount of work the initial cost would be $4,735, and the maintenance expenses $10,394. The estimated saving in maintenance is $2,282 per year.

One motor wagon, with capacity of nine cubic yards, can make three trips per day, resulting in the collection of 27 cubic yards. Five horse carts, with capacity of one and a half cubic yards each, making the usual two trips per day, would collect only 15 cubic yards.

The expense of operating a motor wagon per month, including salaries, fuel and repairs, is $351. The cost of operation of five horse carts is $434 per month.

A motor wagon, making quicker trips from the districts in which it is working, is enabled to give seven and a half hours out of a nine-hour day for actual collection work, while the horse-drawn vehicle now gives but five and a half hours per day to collection of material.

The cost of collection by motor is 50 cents per yard as against $1.11 for the horse-drawn vehicle. The motor bodies may be removed at night and replaced in ten minutes with sprinkling tanks, the apparatus then being sent out during the night to assist in the work of street cleaning.

REMARKABLE SERVICE OF MOTOR AMBULANCE.

WITHIN the past year the steam driven ambulance employed by the health department in Chicago has traveled 36,821 miles, averaging a little more than 100 miles each day. During this period the machine has been twice put out of commission by reason of collision with street cars. The vehicle is equipped with a 20 horse power engine and weighs with its heavy ambulance body 4,556 pounds.

CHICAGO CAB OPERATORS ORGANIZE.

REPRESENTATIVES of the five motor cab companies operating in Chicago have formed the Automobile Transportation Association. This organization will chiefly concern itself with the standardization of administrative methods. It will also solidly oppose legislation which may be considered inimical to motor cab investment.

Two motor buses are being operated between Cotter and Mountain Home in Tennessee.

A motor ambulance has been supplied to the city dispensary of St. Louis. The health commissioner declares that five such machines will do the work now performed by seventeen horse drawn ambulances.

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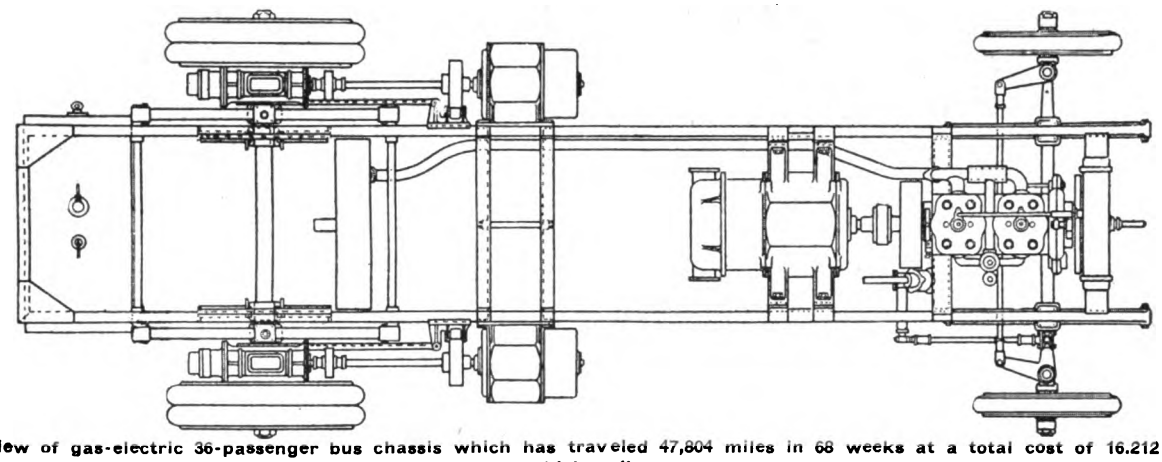

Plan view of gas-electric 36-passenger bus chassis which has traveled 47,804 miles in 68 weeks at a total cost of 16.212 cents per vehicle mile.

Gas-Electric Vehicle Economy

Low operating cost of a heavy machine which has been undergoing test for a long period.

MANY times of late this journal has chronicled the economy of the gas-electric vehicle, even going so far as to intimate that its extensive employment for the transportation of heavy freight seemed imminent. The progress of events apparently has justified this opinion, for not only have several manufacturing concerns become openly identified with such construction, but the service records upon which the prediction was originally based have, as time went on, been better confirmed than past experience with new design would lead one to expect.

After operating a gas-electric 36-passenger bus for 68 weeks, during which period it has traveled 47,804 miles, averaging 703 miles per week exclusive of Sundays, it has been found that the total working cost per mile amounts to 16.212 cents. It is reasonable to suppose that if the establishment which undertook to test the engineering and commercial values of this machine had many such units, instead of one, to administer, the economic showing would be much more remarkable. Reflect that hitherto the best administration of gear driven gasoline buses has been unable to demonstrate a lower working cost than 20.212 cents per vehicle mile, and that the best authentic record for straight electric bus operation stands at 20.9 cents. Bear in mind, also, that these operating costs for both straight gasoline and straight electric vehicles result from the employment of over 300 of the former and 29 of the latter.

* * *

When the gas-electric bus whose preformance we are about to critically examine had been in service for six months, its cost of operation was carefully detailed as follows:

Early Working Costs Per Mile.

	Cents.
Running	1.750
Maintenance	.164
Tires	3.000
Drivers	2.490
Conductors	1.794
Gasoline	2.440
Lubricants	.134
Grease	.010
Paraffin	.100
Vehicle lighting	.268
Body upkeep	.640
Traffic expenses, insurance, rent, taxes, supervision, depreciation, establishment charge, etc.	4.250
	17.040

* * *

It was plain that if this low cost of operation could be sustained for a long period the merit supposed to reside in the gas-electric transmission principle could be considered firmly fixed. With this object in view it was determined to keep the machine in service. Forty-two weeks later its record was again examined and the following distribution of costs found:

* * *

Latest Working Costs Per Mile.

	Cents.
Running	1.800
Maintenance	.462
Lubricants	.132
Grease	.126
Paraffin	.090
Vehicle lighting	.258
Body upkeep	.632
Drivers	2.484
Tires	3.306
Conductors	1.812
Gasoline	2.512
Traffic expenses	.484
Depreciation, insurance, rent, rates, taxes, water, gas, garage lighting, supervision, establishment, etc.	2.114
	16.212

From this carefully compiled and authenticated evidence it may safely be concluded that the gas-electric vehicle is a very superior agent for the transportation of heavy loads, especially in a service which calls for great activity and arduous operation of equipment.

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In the course of the experiment undertaken with this vehicle opportunity was frequently afforded to compare its cost of operation with that of gear driven machines used in the same establishment for the same purpose. Before presenting examples of such comparison it will be well to state that the engineer of the company whose service supplies the figures is regarded as one of the most competent men in the industry. He is charged with the responsibility of economically operating a large fleet of public service machines which, at the low rates prevailing, are with difficulty prevented from losing money. The investment represented by the equipment is in excess of $1,000,000. Under such circumstances it would be ridiculous to think that his bookkeeping is at fault or that his commendation of gas-electric machines is artificially inspired. He gives the following comparative costs of operating the two types of vehicles between which he is called upon to decide:

Gear Drive Operating Cost.

First quarter of 1908.....22.264 cents per mile
First quarter of 1909.....20.350 cents per mile

Gas-Electric Operating Cost.

For 68 weeks.....16.212 cents per mile

* * *

The period during which the gas-electric machine performance was so carefully observed ended July 7, 1909. In that time a mileage loss of 12 per cent was sustained. The bulk of this loss was occasioned by mechanical troubles having no bearing upon the electrical equipment of the test vehicle. No trouble whatever was experienced from the system of control, the commutator, the armature, the brushes and many other features of electrical design.

* * *

A plan drawing of this vehicle is shown at the beginning of this article. Its motors are placed outside the frame, and therefore they and the worm gears through which they drive are very accessible. This machine is regularly employed in public service. The final drive is by shafts from the motors to the rear wheels. The engine, rated at 30 hp., is coupled to a continuous current dynamo, behind which the controller is placed. The motors can be worked in series when the machine is climbing grades, or in parallel for ordinary work. The engine speed can be varied from 350 to 1,050 r. p. m., the latter being maximum speed. The fuel consumption averages about 8 miles to the gallon.

* * *

In defense of this construction the engineer who is so successfully demonstrating it says:

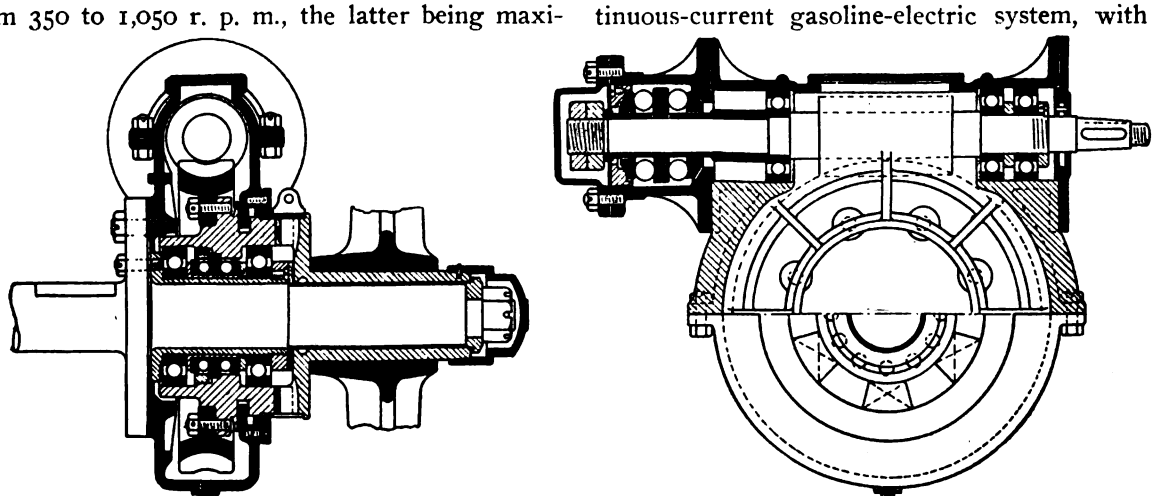
"It is not bills and bad roads that tell on motor buses so much as the continual stopping and starting of the vehicle, the heavy application of the brakes in the former circumstance, and the wrong application of the clutch in the latter. Our vehicle cannot be started from a stationary position with a jerk. It glides away with a gentle, steady movement. This fact alone has a great bearing on the question of abnormal wear and tear. The control, from a driving point of view, is as nearly foolproof as possible, and this can only be properly appreciated by actually driving. In this respect it compares quite favorably with a street car. The field resistance of the dynamo requires a little manipulation on the part of the driver, but not more so than a spark advance and retard lever. It must be emphasized that for average work the driver never need come out of his top, or parallel, position, and thus the main electric circuit never need be broken except when the driver leaves his vehicle and places the controller lever in the neutral position.

* * *

"The night staff on a fleet of such vehicles can be very greatly reduced, and it is confidently estimated that only .5 to .75 man per vehicle would be required. The labor required would be, engine adjusters, brakemen, greasers, cleaners and washers. Electrical labor has been clearly demonstrated to be unnecessary on nightshifts, as the ordinary cleaning of the commutators would be done at the most suitable point on the vehicle's route during the day, the operation only taking a few minutes.

* * *

"If the gasoline engine had the characteristics of the steam engine, without its disadvantages, giving a heavy torque at slow speeds and a smaller torque at high speeds. the product of torque and speed through a large range being practically a constant quantity; or if a highly efficient universal gear of low first cost and low cost of upkeep could be produced, the gasoline-electric system would have no claim to existence. But in the absence of the two conditions we have specified we claim that the continuous-current gasoline-electric system, with a suitable



Worm drive used in gas-electric bus which has been operating for 68 weeks.

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gear as the final transmission from the electric motors to the road wheels, is the nearest approach to the ideal at present attained.

"We employ a comparatively small engine in our gasoline-electric bus. It develops 30 hp. and is very compact and economical in its fuel consumption. We determined to apply the electric motors directly to the road wheels so as to avoid double reduction gears. The rear axle controls the position of the electric motors and permits them to be heavy, robust and efficient, and to run at a normal speed of 1,200 revolutions. The motors are direct coupled to the worm driven road wheels by a 12 to 1 ratio worm gear.

* * *

"This application of electric motors is, we believe, unique. It is direct, and has the further advantage of throwing the motors and transmission gear outside the frame, thus rendering them particularly accessible in common with the universal joints and brake gear. A worm gear of ample proportions, such as we employ, has an exceedingly long life, which is evidenced by the extraordinary results of a Dennis worm drive, mounted on the live axle of a 4½-ton motor bus, of which the worm gear is of smaller proportions than either of those which we employ. A single worm drive, as above quoted, has run 20,000 miles without being appreciably worn. Having thus briefly described the mechanical features of the type of vehicle we favor, we will now go on to more carefully detail the electric unit that occupies the space left vacant between the engine and road wheels.

* * *

"The engine is directly coupled by means of a flexible coupling to a continuous current dynamo of the inter-polar type. This dynamo is capable of generating a current of 0 to 250 amperes at a voltage varying from zero to 200 according to the speed of the engine, the maximum output in kilowatts being 18 when the engine is running at 900 revolutions per minute. The dynamo has a falling characteristic in common with other shunt wound dynamos, and, as a consequence, the voltage increases as the current required by the electric motor decreases. The current from the dynamo is carried through a main switch, which is controlled by the foot pedal, to the controller operated by a lever corresponding to the ordinary gear-changing device, and this speed-changing lever is interlocked with the foot pedal, so that it is impossible to move the controller unless the main switch between the dynamo and the controller is broken. The controller under these conditions must be absolutely sparkless. From the controller the current is carried to the electric motors, which are bolted to the side members of the chassis. These motors are series wound, and the armatures are capable of being connected up in series or parallel, corresponding to the first or second speeds by the action of the controller, the reverse being effected by reversing the current exciting the motor field magnets. Brake drums are fixed to the motor shafts, which also carry universal joints connected to the cardan shafts that drive the worms in the worm wheel cases already described.

"Speaking from an electric point of view, the transmission is similar to that of the ordinary electric car, the engine and dynamo taking the place of the storage battery, with the important advantage of giving an output exactly in accordance with the demands of the electric motors without the necessity of breaking the electrical circuit, as the effect of throttling the engine down to a slow speed causes the dynamo to lose its excitation, which it immediately recovers on the engine speed being accelerated, owing to the action of the inter-poles. The speed of the engine is controlled by a small throttle pedal operated by the right foot, and this pedal in its normal or top position throttles the engine down below the speed required to excite the dynamo, the latter only exciting when the speed of the engine is increased by opening the throttle. This throttle pedal and the brake pedal operated by the left foot are the only pedals used in driving. In series, with the shunt field of the generator, is a small shunt resistance operated from a small lever on the steering wheel; this resistance by controlling the voltage of the generator enables the driver to get the most efficient results at any speed of engine or car. On level roads and very slight gradients the car will run with a stiff field on the dynamo and a slow engine speed. For fast running and hill climbing, however, a weaker field is necessary to enable the engine to get away with the load and give its maximum horsepower, thus providing the electrical equivalent of a universal gear.

* * *

"The construction of the dynamo has a very essential bearing upon the successful development of the system. In common with the electric motors, it must run absolutely sparkless under all conditions of load. Its characteristic must be such that it will generate, approximately, constant watts, the volts and amperes varying in inverse ratio, according to the requirements of the series-wound motors, which demand current in almost direct ratio to the torque demanded by them by the road conditions. As the power of the engine is limited, the volts must necessarily fall to keep the load on the engine constant. To this end the dynamo must have a falling characteristic similar to that of a shunt-wound generator. But, owing to its special duties, a simple shunt field winding would be unsuitable, as the armature reaction, with a heavy main current, and a weak field—conditions occurring when the vehicle is negotiating a steep hill—would cause heavy sparking and, as a result of the armature reaction, the machine would lose its excitation at a time when its power is most required.

* * *

"The dynamo we have adopted is of the inter-polar type. The object of the inter-poles is automatically to correct the effect of armature reaction. They are excited by a heavy winding, in series with the armature, which winding is so proportioned that the inter-poles enable the main poles to resist the distorting effect on their magnetic field which is set up by the reaction of the armature. The heavier the current through the armature, the heavier the current through the inter-poles. By their use a fixed brush position is possible under any condition of load.

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"One effect of armature reaction is to render the position of sparkless commutation unstable, owing to the varying loads on the armature. With a well-designed shunt-wound dynamo, generating current at a practically constant voltage, this action may be neglected; but with a dynamo with a field strength dropping to a third of the normal, and an armature taking heavy overloads at the time the field strength is at its lowest, the sparking would be excessive, and quickly ruin the commutator.

* * *

"The controller is arranged to give two forward speeds, a neutral and a reverse. By the interlocking action of the foot pedal, which operates the main switch, it is impossible to move the controller—operated by the side lever in the same way as the ordinary gear-changing device—until the electrical circuit between the dynamo and controller is broken, thus insuring that the controller is absolutely sparkless under any condition, and at the same time rendering it impossible for the driver, through carelessness or intent, to injure the electrical equipment in any way.

"The current is taken from the controller to the two series-wound motors bolted to the outer sides of the frame, with which their shafts are parallel. These motors are of larger construction than those usually used on gas-electric vehicles, in order to obtain high efficiency on heavy gradients. It is obvious that the motors must be of a powerful type, as they are required to give out their maximum power when running slowly and giving a heavy torque. These conditions do not apply to the dynamo, which runs at its highest speed when giving its maximum output.

* * *

"For ordinary bus work all the driving is effected on the top speed, with motor armatures in parallel. The main circuit between motors and dynamos is not broken, the control being entirely by engine speed. It should be noted that at a speed of less than 500 revolutions per minute the dynamo fails to excite. The series parallel control enables the torque on the motors practically to be doubled when their armatures are in series, and, as a result, the speed is reduced in the same proportion. The voltage across each armature is half the terminal voltage of the dynamo under these conditions. Speaking generally, it may be taken that the speed of the motor is proportional to the volts, and the torque proportional to the amperes.

"We may say as an illustration of the peculiar conditions met with in gas-electric work, that if the dynamo is capable of generating 16 kilowatts—8 kilowatts for each motor—the efficiency of the motors will be 53 per cent, this increase in efficiency being due to the voltage being doubled in the case of the 16-kilowatt supply, the amperes remaining the same, and the losses in the motors being practically the same as in the first instance. This illustrates what might occur in a vehicle with a wrongly calculated gear ratio, using motors which under better working conditions would give an efficiency of over 90 per cent.

* * *

"In our experience the best gear ratio for electric motors, of the dimensions that we are employing, is from 12 to 1 to 16 to 1, the former for city work, and the latter for country work. With a 16 to 1 gear ratio the efficiency of transmission in a gas-electric vehicle, weighing, loaded, 7 tons, on a hill of 1 in 12, including all electrical losses, and allowing 10 per cent for gear losses, will work out at 70 per cent from the engine to the road wheels. The efficiency of a 12 to 1 gear ratio under these conditions is 67 per cent. On ordinary 'give-and-take' roads, the total efficiency from the engine to the road wheels averages over 70 per cent. The efficiency is, after all, best estimated by results, and in gasoline consumption our vehicle will compare very favorably with the best gear-driven vehicles now in operation.

* * *

"Owing to the nature of the control on our vehicle, it is impossible for the driver to injure the electrical equipment by any means in his power. As our omnibus is practically free from vibration, owing to the absence of spur gearing, the dynamo and motors, fixed on a comparatively light spring frame, are working under conditions at least as favorable as the ordinary electric motor used for industrial purposes. All shafts run on ball bearings, and each motor is, in addition, fitted with a double ball-thrust bearing to take the side strain from the bearings due to the weight of the armatures on heavy gradients."

One-fifth of the London horse cabmen are to try the virtue of an initial charge of 12 cents in competition with the motor cab initial charge of 16 cents.

Twenty motor cabs are being shipped for service in Winnipeg, Man. They will be operated by the Bruna Taxicab Company, which maintains service in Montreal and Toronto.

Motor cab service is to be provided in Utica, N. Y. At the outset three machines will be employed.

Suit for $5,140 damages has been brought against the Pueblo (Colo.) Taxicab and Automobile Company by the guardian of a boy who was run down by a machine which, it is alleged, was exceeding the legal speed limit.

The total expense for mechanical replacements in a Brtish 10-12 hp. gasoline cab which has been operated in considerable number for a period of three years, is said to be .006 cents per mile.

The authorities of Nahant, Mass., have decided to purchase a motor hose and chemical wagon at a cost of $3000.

The director of public safety in Massilon, Ohio, advocates the purchase of motor fire vehicles. He also favors the employment of motor cycles for police patrolmen.

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Care of Storage Batteries

Continuation of address recently read before the Society of Automobile Engineers by H. M. Beck.

DISCHARGE very largely takes care of itself, except that a battery should not be run down below its voltage limit. The rate of current has very little effect upon the life of the plates, provided the discharge is not carried down too far. Where a battery is completely discharged it should be charged as soon as possible, and if it has been run down too low the charge should be continued to a maximum similar to the overcharge.

* * *

The Ampere-Hour Meter.

Many attempts have been made to develop apparatus which would automatically show the charge and discharge of a storage battery, but these have either been based on the wrong principles or else the instruments would not stand the wear and tear to which they were subjected, and they have therefore not proved satisfactory. Within the last year or so, however, a mercury type of ampere-hour meter has been placed on the market, designed especially for battery use, and so far the results obtained have been very promising. This meter is equipped with a large dial and a pointer which can be set by hand to any point desired. The pointer revolves in one direction during charge and in the opposite direction during discharge, and registers directly the ampere-hour output or input to the battery. The mercury in which the armature disk is submerged acts as a dash-pot, and seems to be very effective in damping the vibrations and jolts which such a meter has to stand.

During discharge the meter shows directly what capacity has been taken out, so that it is a simple matter to determine what is left in the battery. For charging the procedure is somwhat more complicated, although not seriously so. It is necessary to charge a battery for from 15 to 20 per cent more ampere-hours than are discharged in order to make up for the losses in the battery. The method used to accomplish this is to move the pointer ahead the proper number of ampere-hours just before charging, then charge until the pointer comes back to zero. The meters are equipped with an electrical contact at the zero point, which can be made to automatically open the circuit if desired. As will be seen, this considerably simplifies the handling of the charge, but there is one point which must not be overlooked and which should be strongly emphasized—namely: that the efficiency of a battery varies with the character of work it does, being much lower for light work than heavy. In fact, as long as in commission, the battery needs regular charges, even if it does no work at all; in other words, its efficiency would then be zero. This variation in efficiency can be handled in several ways. Under average conditions it is probably safe to charge by the ampere-hour meter for a set period, say two weeks, provided at the end of this period the battery is given a regular overcharge.

An alternative method is to give an additional charge once a week by the meter of whatever number of ampere-hours is found necessary to keep the battery up. The regular bi-weekly overcharge will probably be found to be the safer method, especially in private service, where the conditions are so variable, but whatever method is used, too much emphasis cannot be laid upon the fact that if a battery is to be kept in good condition, in addition to the ordinary charges with the ampere-hour meter, regular overcharges must be given. The meter certainly gives promise of reducing the amount of attention a battery requires, but the danger is that it will therefore be assumed that it will eliminate all of it.

* * *

Battery Short Circuits.

Short circuits between the plates are largely eliminated through the use of the wood separator. This point, therefore, does not need any special attention beyond that of seeing that the separators are in good condition when installed. With the sediment under the plates, however, the case is different. It is a natural tendency to wish to run a battery as long as possible before putting it out of commission for overhauling. The result is that very generally the sediment is allowed to get up to the plates before the battery is washed. When the sediment reaches the plates there is a discharge of wasted current through it, which in turn necessitates that the cell be given more charge in order to hold it up, and the extra charging again throws down still more sediment. Further, the sediment becomes sulphated and by local action with the active material of the plates in contact with it, causes the active material to become sulphated, which again increases the tendency to washing out. The result is that the plates begin to lose their active material rapidly if the sediment is allowed to collect until it reaches them, and it is, therefore, evident that if a battery is to give its normal life, it is absolutely essential that the sediment be cleaned out before, and not after it reaches the plates. The rate at which the sediment collects depends largely upon the way a battery is handled, and it is therefore necessary to determine this rate for each individual case. A cell should be cut out after, say fifty charges, the depth of sediment measured and the rate so obtained used to determine the time when the battery will need cleaning. As there is apt to be some variation in the amount of sediment in different cells, and as the sediment is thrown down more rapidly during the latter part of a period than at the beginning, it is always advisable to allow at least ¼ inch clearance. If the ribs in the bottom of the jars are 1¾ inches high, figure on cleaning when the sediment reaches a depth of 1½ inches.

* * *

Washing Batteries.

Before dismantling a battery for "washing," if practical, have it fully charged. Otherwise, if the plates are badly sulphated, they are likely to throw down considerable sediment on the charge after the cleaning is completed.

There have been a great many complaints of lack of

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capacity from batteries after washing. Almost without exception this is found to be due to lack of a complete charge following the cleaning. The plates are frequently in a sulphated condition when dismantled and in any case are exposed to the air during the cleaning process, and thus lose more or less of their charge. When reassembled they consequently need a very complete charge, and in some cases the equivalent of the initial charge, and unless this charge is given the cells will not show capacity and will soon give trouble again. This charge should be as complete as that described elsewhere in connection with the initial charge.

* * *

Replacing Evaporation in Cells.

"Flushing," or replacing evaporation in cells with electrolyte instead of water, is a most common mistake. The plates of a storage battery must always be kept covered with electrolyte, but the evaporation must be replaced with pure water only. There seems to be more or less general tendency to confuse the electrolyte of a storage battery with that of a primary cell. The latter becomes weakened as the cell discharges and eventually requires renewal. With the storage battery, however, this is not the case, at least to anything like the same degree, and unless acid is actually lost through slopping or a broken jar, it should not be necessary to add anything but water to the cells between cleanings. Acid goes into the plates during discharge, but with proper charging it will be driven out again so that there will be practically no loss in the specific gravity readings, or at least one so slight that it does not require adjustment between cleanings. Thus, unless some of the electrolyte has actually been lost, if the specific gravity readings are low, it is an indication that something is wrong, but the trouble is not that the readings are low, but that something is causing them to be low, and the proper thing to do is to remove the cause and not try to cover it up by doctoring the indicator. The acid is in the cells and if it does not show in the readings, it must be in the form of sulphate, and the proper thing to do is to remove the cause of the sulphation, if there is one, and then with proper charging drive the acid out of the plates and the specific gravity readings will then come back to the proper point. The too frequent practice in such cases is to add electrolyte to the cells in order to bring up the readings, which, as already explained, are only the indication of the trouble, and this further aggravates the condition, until finally the plates become so sulphated that lack of capacity causes a complaint.

This practice of adding electrolyte to cells instead of water seems to be becoming more and more common. In general, it is much the safer course to assume that the electrolyte is all right, and look for trouble elsewhere, than to attempt to doctor it by the addition of more acid, and a great deal of trouble today is the result of a misunderstanding of this one point.

* * *

Restoring Low Battery Cells.

The treatment required for bringing a low cell or battery back into shape, while quite simple, is one of the most misunderstood parts of battery operation. The causes of low cells may be very varied, but the results produced and consequently the treatment required are not so varied. The general procedure is as follows:

First—Restore the cell mechanically.

Second—Renew the electrolyte if there is any question as to its purity.

Third—Restore the cell electrically by charging.

* * *

Mechanical Restoration.

Before dismantling a cell, if practical, have it fully charged; the mechanical restoration then simply covers the operation of examining the cell and putting it as nearly as possible back into its original condition. This should not be difficult for any one who is familiar with the assembly of the elements.

Where there is any question as to its purity, the electrolyte should be renewed, as the expense is not great in the case of the small cells used in vehicle service, and it would hardly pay to have an analysis made. Where any considerable amount of electrolyte is under suspicion, the manufacturers will gladly analyze samples. It is well to always have the water used for replacing evaporation and new electrolyte, unless furnished by the battery manufacturers, tested.

The most marked effect of an impurity is to cause the plates to become a bad color, the cells to become inefficient electrically, and in extreme cases the plates may be ruined.

When the electrolyte is renewed, the jar and plates should be thoroughly washed and the new electrolyte should be of about the same strength as that renewed, in order to allow for any acid which may be in the plates.

* * *

Electrical Restoration.

The electrical restoration has been probably the greatest stumbling block, and largely through lack of understanding, as this operation consists in simply charging the cell until a maximum voltage and gravity are reached. The common mistake is to cut off the charge before it is complete, in which case the plates, being still sulphated, will not show capacity and are likely through local action to soon get into bad condition again.

* * *

Abnormal Sulphating and Its Cure.

With the possible exception of trouble due to an impurity, it can be generally stated that chemically the final condition requiring treatment is abnormal sulphating, and even where an impurity is present in the electrolyte, its action is assisted by sulphating. It should be understood that sulphating is a normal as well as an abnormal process in the charge and discharge of storage batteries, and the difference is in the degree, not the process. The abnormal condition is that ordinarily referred to by the term. In normal service, sulphating does not reach the point where it is difficult to reduce, but if carried too far the condition becomes so complete that it is difficult to reduce, and injury results. A very crude method of illustrating the different degrees of sulphating is to consider it as beginning in individual particles uniformly distributed through-

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out the active material. Each particle of sulphate is then entirely surrounded by active material. The sulphate itself is a non-conductor, but being surrounded by active material the current can reach it from all sides and it is easily reduced. This is normal sulphate. As the action goes further, the particles of sulphate become larger and join together and their outside conducting surface is greatly reduced in comparison with their volume, so that it becomes increasingly difficult to reduce them and we have abnormal sulphate.

The general cure for sulphating is charging, so that a cell having been mechanically restored the electrical restoration consists simply in the proper charging. Sulphate reduces slowly and on this account it is a good plan to use a rather low current rate. High rates cause excessive gassing, heating, and do not hasten the process appreciably, so that it is the safer as well as the more efficient plan to go slowly. A good rate is about one-fifth of the 4-hour discharge rate. The length of charge will depend upon the degree of sulphating. In one actual case it required three months' charging night and day to complete the operation, but this was, of course, an exceptional one. The aim should be to continue until careful voltage and gravity readings show no further increase for at least ten hours and an absolute maximum has been reached. In serious cases it may be advisable to even exceed the 10-hour maximum in order to make absolutely sure that all sulphate is reduced, and where there is any question it is much safer to charge too long, rather than to risk cutting off too soon. A partial charge is only a temporary expedient; the cell, being sulphated, will drop behind again.

* * *

Blaming the Battery for Vehicle Trouble.

Since the specific gravity readings are affected not only by the charge but also by the evaporation and changes in temperature, it is advisable, where an absolute maximum is to be reached, to eliminate these. The evaporation should be replaced with sufficient frequency to keep the electrolyte accurately at a fixed height above the plates. In this way water is added so frequently that very little has to be added at any one time, and the effect on the specific gravity readings is negligible. The temperature variations are eliminated by reading the temperature of the electrolyte, when specific gravity readings are taken, and correcting the latter to some standard temperature, such as 70 degrees F. This correction is made by adding one point—.001 specific gravity—for every 3 degrees above 70 degrees Fahrenheit and subtracting one point for every 3 degrees below 70 degrees Fahrenheit.

When the charge is complete the specific gravity of the electrolyte should be adjusted to the proper point and the cell is ready for service. Where there is time and the facilities are at hand, it is a good plan to take a test discharge in order to make sure that everything is all right.

Failure in the restoration of low cells is probably more often due to cutting off the charge too soon than to any other cause, and from the troubles which are being reported this point evidently needs to be brought out more strongly.

Wrongfully Putting Blame on Batteries.

In closing, a word or two about the vehicles themselves. As manufacturers we wish to admit without argument that the battery is the most important part of the vehicle, but, on the other hand, we would like to protest against the frequent practice of blaming the battery for everything that goes wrong. The battery is rated in ampere-hours, not mileage, and when the mileage of a vehicle falls short trouble should be looked for in the vehicle as well as in the battery. Batteries are usually rated at their four-hour discharge rate, this being about an average running rate for vehicles. The capacity, however, varies widely with different discharge rates, decreasing as the rates increase, so that anything which causes the vehicle to consume more current will more than proportionally reduce its mileage. For example, suppose that due to inefficient tires, poor bearings or binding brakes a normal current of 20 amperes is increased to 30 amperes. If the ampere-hour capacity were still the same and there were no other losses, the mileage would be reduced about one-third. This increase in current, however, reduces the actual capacity of the battery by about 10 per cent. The average discharge voltage is also reduced and the drop in wiring of the vehicle is increased, so that the watts delivered to the motor are still further reduced, and finally the motor itself is somewhat less efficient at the higher rate, so that the net result is that the mileage of the vehicle instead of being reduced by one-third, is actually cut down about one-half. It is thus evident how important it is that the vehicle as well as the battery be kept in the best of condition.

As has already been stated, no attempt has been made to cover many of the details of battery operation, but rather to emphasize and explain some of the most common errors found in the handling of the vehicle batteries of today, and of these probably that which should be brought out most forcibly is the matter of flushing cells with electrolyte instead of water. Keep the plates covered with elctrolyte, but use only pure water, not acid, for replacing the evaporation.

Motor cabs will soon be operating in Tyler, Tex.

The German government is testing a new gas-electric military road train.

A motor hose and chemical wagon is to be installed in Binghamton, N. Y.

The authorities of Savannah, Ga., have resolved not to buy any more horse drawn fire apparatus.

The commissioners of Washington, D. C., have appropriated $5,500 for the purchase of a motor fire engine.

The chief of the Montgomery, Ala., fire department has recommended that horses be retired in favor of motors.

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OPPOSITION HAS CEASED.

COMMENTING upon the efficiency of motor fire apparatus the "Fireman's Herald" observes that horse hauled vehicles are rapidly being retired in all branches of service. Opposition to motors in fire service, it is remarked, has practically ceased, the economy, reliability and superior efficiency of the machines being well proven in practice. To quote:

"Though the first outlay may be greater than for apparatus of the older type (and that is not always so) the saving in horseflesh, horse feed, harness and its repairs, shoeing and the like, in addition to dispensing with the services of a driver, very soon offsets the original cost of purchase, while, with well-built, well-cared for and skillfully driven machines, the chances of an accident or a breakdown are no greater than if they were hauled by horses. In New York alone there is constant proof of this fact, since a week never passes without some accident happening to the drivers of ordinary apparatus or their horses in transit to or from a fire. The only argument against such machines that is worthy of serious consideration is that, as perfection has not yet been attained in building them, it is better to go slowly in their adoption. The same style of reasoning, however, has been adduced against every invention, and if there had been in existence those capable of such a style of reasoning when the creative work first began, doubtless the Almighty would have been bombarded by objections from the beginning of the development of his scheme, first in getting the world ready for the dwelling place of man and then in the creation of man himself. No invention, no created work is perfected at once, as was the case with the human race itself. It is developed from some crude beginning, and improved more or less rapidly as time goes on. Auto apparatus will doubtless be bettered, but that is no reason why it should not be accepted in its present by no means imperfect form. These are no longer the days for long waiting in adopting obvious improvements."

The city council of Elwood, Pa., is considering the purchase of motor fire apparatus.

REMARKABLE CAB-FRAME DESIGN.

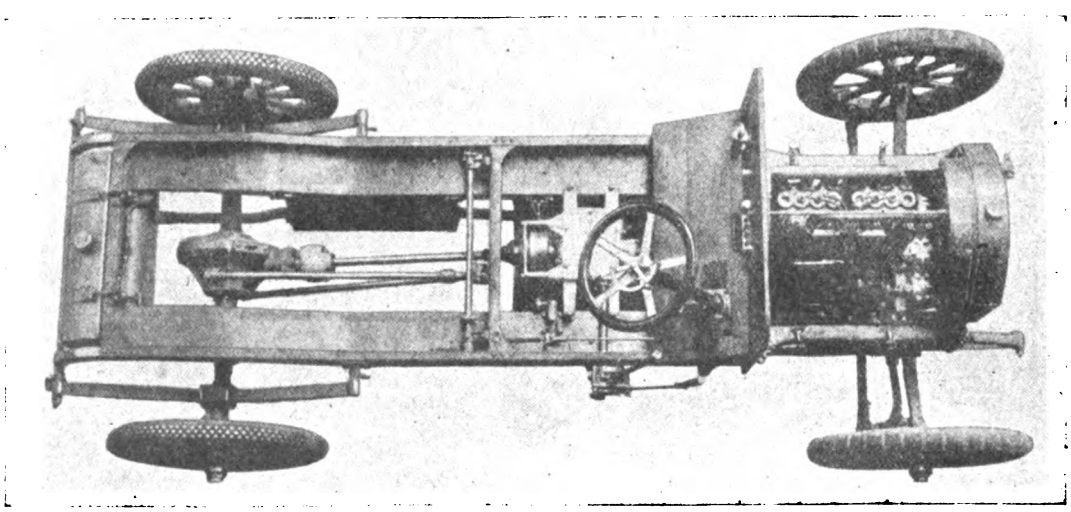
THE pressed steel longitudinal frame members of the latest cab to be put on the British market are of very remarkable design. Their formation avoids the use of gusset plates and a subsidiary frame. The strength of the construction may be inferred from the picture shown below. Three pressed steel cross members hold the wide lognitudinals together. The longitudinals widen at the point where the frame is inswept. In the rear the frame is upswept. Great strength and simplicity of design are the characteristics of this frame.

MOTOR BUSES THAT PAY.

HUNDREDS of small motor bus enterprises in this country earn handsome profits for their operators. Much of this success is due to the fortunate conditions of service as well as the high charge which is exacted for it. If, however, these undertakings were conducted in the face of stiff competition, as is the case in London, where two cent fares prevail, it is likely that far different results would be obtained. The London motor bus service, though of enormous proportions, is only profitable when extreme care is exercised in administering machines which are soundly designed. This is a combination seldom encountered, but that it actually exists is made evident from a glance at the financial conditions of the Great Eastern company, which employs 50 vehicles of the double decked variety.

This concern is now in its fourth year of operation. Its third year of service ended last June, with a balance of $36,398.40 to credit after all expenses had been deducted. A dividend of 5 per cent on the capital stock of $500,000 absorbed $25,000 of the net profit, leaving $11,398.40 to be carried forward. Since June the directors have raised a mortgage of $100,000, out of which they paid off a temporary loan of $70,000 and added $30,000 to their cash resources.

A 90 hp. fire department machine has been installed in Galveston, Tex.



Remarkable frame for motor cab chassis.

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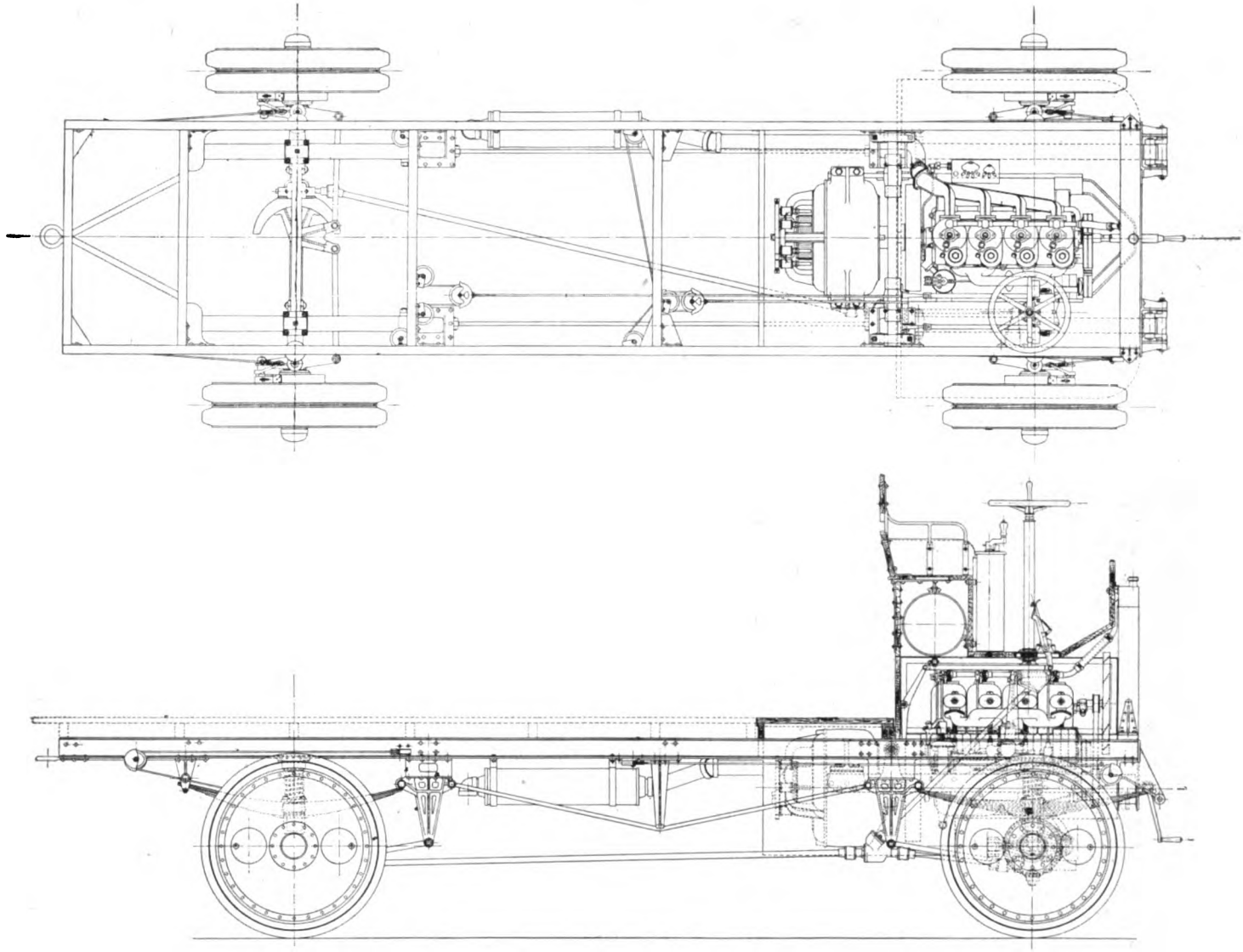

Plan and side elevation views of the gas-electric 3½ ton model made by the Couple Gear Company.

Two Standard Gas-Electric Trucks

Detailed description of a design which gives remarkably high efficiency in service.

EXTREMELY high efficiency is the characteristic of two gas-electric trucks, of 5 and 3½ ton rating, being produced by the Couple Gear Freight Wheel Company, of Grand Rapids. These machines have no starting clutches, no long shafts or countershafts with their bearings, no change speed gears, no differentials, no sprockets, chains or live rear axles, and no frictional surfaces. The functions of all these parts are performed by generator, wiring, driving motors, and a balanced means for imparting the force of the electric motors in the driving wheels to the rims thereof at two opposite points. It is claimed that the total efficiency, including electrical losses, averages higher than it is possible to secure by the best design of mechanical transmission for such work as these vehicles are designed to perform, while the mechanical losses, aside from those of the engine, are nearly all eliminated. Mechanical losses are represented in wear of mechanical parts, while electrical losses are all dissipated in heat at low temperatures and cause no wear or depreciation whatever. On such a showing these vehicles should be unusually durable and reliable in service.

For some years past the Couple Gear company has been quietly maturing the design which it is here proposed to consider. Examples of its work in this direction were first exhibited in gas-electric trucks supplied to the war department for field service, to the Chicago City Railway Company for emergency work, and to the executives in charge of the observatory on Mount Wilson for the transportation of supplies to the summit of that peak. All of these machines accomplished their work with such success as to induce the manufacturers to standardize and refine the design. Excepting the source of power, the new models are identical with the company's four-wheel-drive electric trucks.

* * *

In that class of service calling for high mileage and large loads it has been very definitely established that the

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gas-electric vehicle is singularly economical. This statement is justified by the results which have been obtained from the service of such a machine operating in London bus traffic for a year and a half, during which time it has traveled almost 50,000 miles. The severity of this service is well known. Early reports of the success of the gas-electric bus are now abundantly confirmed, as is evident from the accounting presented in another part of this issue. The absence of those mechanical parts which occasion the bulk of road and barn expense is obviously the cause of this happy condition. Not only is mechanical upkeep low, but repairs are easily, cheaply and quickly accomplished. This latter is a point of no small advantage in a service which calls for the active utilization of the entire road equipment.

* * *

In the Couple Gear company's gas-electric models the source of power is a 45 hp. four-cylinder, four-cycle engine which is connected directly to an electric generator designed for this particular service. The current is conducted from this power unit through suitable wiring to the driving motors in all four wheels. The revolving of the generator produces no current except when a supply of it is being used, and then only in the exact amount required. The labor of the engine also is in exact proportion to the current produced by the generator. As long as the engine is supplied with fuel electric current is available for driving the vehicle. The power plant, of course, may have auxiliary uses, as it is capable of supplying current at any voltage from 40 to 150. Smoothness of operation and flexibility of motion are two distinguishing features of design.

* * *

In a gas-electric vehicle the engine is given a better opportunity to properly perform its work than in the straight gas-engined vehicle. The range of engine speed is from zero to full, with a perfect graduation, and the vehicle can be operated efficiently and continuously at any speed which may be deemed best suited to the existing road and load conditions. It is of further interest to note that the engine can be run at the speed which is best suited for the work it is performing, regardless of the speed of the vehicle, and that this desirable condition is largely automatic. The acceleration is very rapid and smooth. There are no sudden shocks, either in starting or changing from one speed to another, and their absence effects a substantial saving in the cost of maintaining the engine and every other part of the vehicle. Engine control is reduced to its simplest terms. There is no occasion for changing the position of the spark, or if there is it is automatically accomplished. The throttle is operated by a foot lever. The electrical controller has only two positions and reverse. An electric brake is set by a backward movement of the handle of the controller. Two pairs of mechanical brakes are operated by foot levers. The same range of speed is obtained in going forward and reversing.

The unladen weight of any commercial motor vehicle is considerably less than its storage battery vehicles of similar ratings, and no more than straight gasoline trucks of equal load capacity which are constructed for durability of service.

The advantages of four-wheel drive and four-wheel steering may not be disputed. Where bad road conditions prevail, and especially in winter service, such construction in vehicles of heavy load capacity very frequently demonstrates its worth. It also permits the accurate maneuvering of trailers.

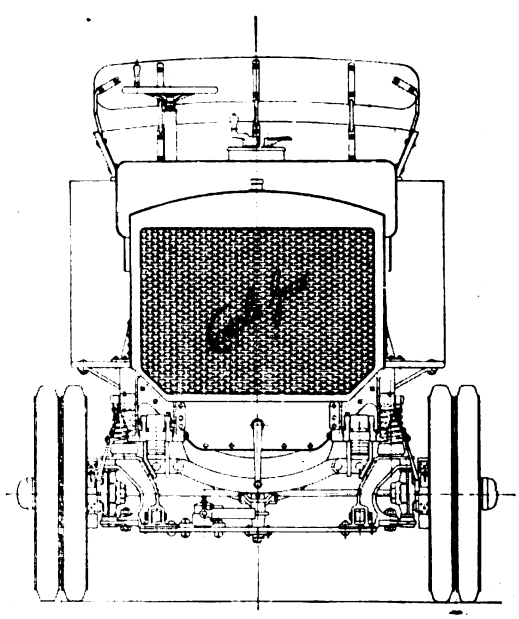
* * *

The balanced means for imparting the force of the electric motors in the driving wheels to the rims thereof, mentioned in the beginning of this article, produces what is known in mechanics as "couple action," from whence the name "couple gear" is derived. There is a balanced division of the work between the two pinions of the wheel which is accomplished by a rocker device in the armature shaft that is technically known as an "evener." The axle stubs on which the wheel turns are integral with the motor castings and an elongation of the inside stub (not shown in the cut) is keyed in a taper sleeve in the steering knuckle, and this holds the motor in a fixed horizontal position while the wheel revolves around it. The armature sets at a slight angle to the plane of the wheel to permit the two pinions to engage their respective halves of the double cog rack while they remain free of the other half. This enables them to work from their opposite sides and to thereby cause the wheel to revolve.

* * *

The extremely high efficiency of the Couple-Gear is accounted for as follows:

1st. The entire force exerted by the motor is in the direction in which the wheel is turning, and there is no pressure on the wheel bearings, except that caused by gravitation. (It is the same as winding a watch with the thumb and finger, except that the motion is continuous. All other methods of transmitting the power to an automobile wheel are to one side of the wheel only, which method uses the axle as a fulcrum in applying the force to the ground.)



Front elevation of 3½ ton gas-electric model made by the Couple Gear Company.

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hicle is a matter of very considerable importance. The Couple Gear company's gas-electric trucks weigh consider-

2nd. The two driving pinions, each having one-half of the work to do, are much smaller than would be necessary under ordinary conditions. This makes possible the single reduction of 25 to 1 and avoids the losses of a countershaft arrangement.

3rd. By virtue of the "evener" device, which causes the pinions to work on a balance, the theoretical rolling action between the gear teeth is more nearly approached than in ordinary gearing, thereby increasing the efficiency and greatly reducing the wear.

4th. The usual end thrust of the bevel pinion is overcome by the equal tendency of the other pinion in the opposite direction.

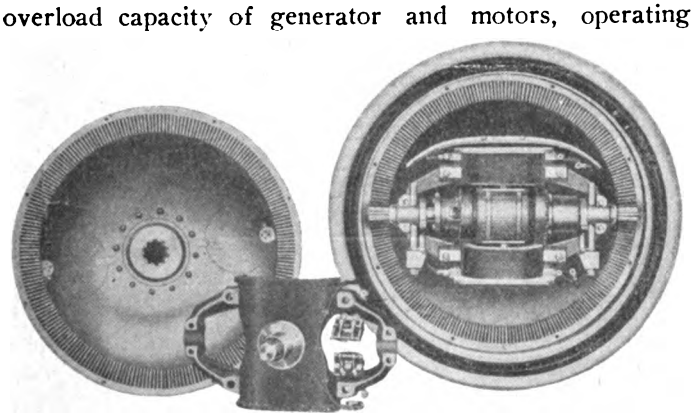
The Couple Gear company guarantees that in the design of their gas-electric trucks there will be a loss of less than 3 per cent from the driving member to the driven member, considering the motor in the wheel as the driving member.

* * *

The 3½-ton vehicle may be operated at 12 miles an hour loaded and 16 miles an hour without load. The crankshaft of its engine is of the five bearing type. Its nickel babbitt bearings are supported by steel rods, which also hold the cylinders to the base—a form of construction which relieves the crank-case of working stresses. Splash and forced feed lubrication methods are employed. Jump spark ignition is obtained from a gear-driven magneto. The weight of the engine and fly wheel is 600 pounds.

The generator, especially designed for this class of work, was built in the Couple Gear Company's factory. It is rated 12½ kw., at 100 volts, 680 revolutions per minute, and will run sparkless with an ampere load 300 per cent in excess of its normal rating and with a 100 per cent rise in speed. The voltage at maximum speed can be held down as low as 40. Its generator is a 6-pole machine with the same number of commutator poles, compound wound with a dropping characteristic. The voltage begins to drop when the amperes exceed 70, which automatically enables the engine to hold or increase speed at approximately the same rate as the increase in power which is being demanded for vehicle propulsion. The weight of the generator is 765 pounds.

The draw-bar pull required to move the empty truck on a good level road is approximately 150 pounds. The overload capacity of generator and motors, operating through the couple gear, is sufficient to give a maximum draw-bar pull of 5,000 pounds, or 33 times as much as is required to move the vehicle on a level.



One of the four driving wheels of the Couple Gear Company's 3½ ton gas-electric truck.

The motors, also the company's own design and manufacture, are rated 33 amperes at 80 volts. They have a momentary overload capacity of 200 per cent. The motors are operated either in series parallel or series, being governed by a controller of the street railway car type. Ignition is fixed. Engine and generator are mounted on a sub-frame at three points, and the power plant is thus relieved from any twisting strains while the road wheels are accommodating themselves to any uneven surfaces.

The tread of the 3½-ton model is 66 inches, the wheel base 144 inches, the body load length 14 feet, the length over all 18½ feet, and the fuel tank capacity 16 gallons.

The road speed of the 5-ton model may be varied from 9 to 12 miles an hour, the former with load and the latter without load. The specifications of this model are similar to those of the 3½-ton machine except that heavier construction is employed throughout. The engine of the 5-ton model has one-half inch greater stroke than that of the 3½-ton model.

STATE AUTHORITY INDORSES MOTORS.

BEING somewhat in doubt about the boasted advantages, economical as well as utilitarian, of motor-driven fire vehicles, the city clerk of Quincy, Ill., recently undertook to obtain an unprejudiced opinion concerning the advisability of installing such machines. Accordingly he wrote to the engineer of the governing committee of the state board of underwriters, and in response received the following reply:

"I am of the opinion that the automobile engine is as reliable as the steam engine, and is superior in point of speed in reaching fires and in quickness of operation of pumps. Reliable evidence indicates that the possibility of delays is no greater in self-propelled apparatus than in horse-drawn apparatus.

"Financially, the automobile engine seems to have an advantage, as it (in a combination machine) dispenses with the driver of a hose wagon, and also an engineer and a stoker of horse-drawn apparatus. Statistics show that the cost of maintenance of the automobile engine is lower than that of the steam engine.

"It is further believed that the streams from rotary pumps, such as are utilized on the automobile fire engine, are steadier than those from a reciprocating pump, such as is generally employed by steam fire engines."

The installation of a combination motor police and hospital wagon is being considered in Lowell, Mass.

The purchase of motor vehicles for the fire and police departments is under consideration in Haverhill, Mass.

One of the volunteer fire companies of Phœnixville, Pa., has installed a motor hose and chemical wagon which cost $5,000. The machine carries a crew of 14 men.

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Motors vs Horses

Defects of Horse Transportation.

GENERATION after generation we have been so dependent upon horse transportation for our persons and our merchandise that we accept all its drawbacks without a thought or a murmur. The possibility of abolishing horse traffic in our large cities never occurs to us. Nevertheless the desirability of such a move is only too patent when a little thought is given to its pros and cons.

Residence and business districts are polluted by the presence of the unsanitary stable. Even the value of real estate depreciates where the undesirable stable is located. Odors, rats and flies are bred where it is found. Wagon loads of hay and straw and feed need not be carted through the streets, and then away again in less agreeable form, were the stable abolished.

When our hauling is done by power-driven vehicles all the streets of our cities can be smoothly paved with wooden blocks or asphalt. Cost of street paving and repairing will be greatly reduced, as the rubber tires of the motor wagon do not cut into the asphalt as the narrow steel tires of buggies and the calks of the horses' shoes do. The volume of noise will also be reduced greatly, and with this, and the doing away of filth in the streets, life in houses fronting city thoroughfares will become more endurable. At the same time the property will increase in value, thereby increasing the taxable valuation.

Experience has taught many users that a motor wagon will do the work of from one and one-half to three horse-drawn vehicles, according to the nature of the work and the size of the vehicle. It may be seen from this that with the substitution of the motor for the horse, traffic congestion will be greatly relieved. Street blockades caused by the balking of horses and the overloading of wagons will be entirely done away with. The motor will seldom get stalled on an up-grade as a horse does. The breakage of a wheel or axle on a motor truck is of very rare occurrence, as the machine is invariably built stronger than a wagon.

The humanitarian side of the case is also a very important one. The sight of a team of horses struggling for a foothold on a slippery pavement and smarting under the lash and oaths of an angry driver, is a sight that may well stir anyone to pity. Neither can we grow accustomed to horses dropping dead in the streets from overwork under a hot sun. A driver may overload a motor truck, but he will scarcely kick it, swear at it, or lash it if it is stalled.

Almost all the dust in the streets is the result of the employment of horses. If horses should be forced from the cities, street cleaning would be greatly reduced. The health and comfort of the inhabitants would be greatly increased by the abatement of the dust nuisance, and rats, sparrows and flies would be much less in evidence.

With the better paving of the streets bus lines, such as are used in the European capitals and in New York, would greatly relieve the transit situation. Automobile fire fighting apparatus could also take the place of the slow and dangerous horse-drawn outfits.

All considerations—sanitary, monetary and those of comfort and convenience—show the great desirability of the displacement of the horse by the motor propelled vehicle.—*Cleveland News.*

* * *

The Horse in City Life.

SINCE history began the horse has shared all man's victories; has bled with him on the battlefields; fallen with him in defeat; thirsted and hungered with him on the unexplored deserts; carried him out of dire perils and into great successes; has hauled his pleasure vehicles and groaned beneath the never ending burdens of the great cities. But today the "horseless wagons" are slowly driving the horse from the larger cities, and the time is not far distant when the horse will be entirely banished to the rural districts. The destruction of human life caused by germ-laden dust, to which the horse is the chief contributor, more than warrants that the animal should be forbidden in the streets of the crowded cities the same as oxen, goats, sheep and cattle.

But there are a great many economical reasons, aside from health arguments, why the horse is rapidly disappearing in the cities. A large per cent of the added cost of living in the cities is due to the unnecessary cost of trucking. There are 120,000 horses in New York City alone and over half of them are employed in trucking. It has been proven by actual test that one auto-vehicle will do the work of from four to six horses; this means that $18,000,000 would be saved annually by substituting auto-delivery wagons. It is well within the bounds of reason to say that at least twenty-five per cent of the cost of vegetables, fruit, meats and other supplies in the cities is due to the fact that they must be hauled to the consuming masses by horses.

In the country districts the horse has an enduring value. But sanitary science is confronted by the fact that in the cities of this country there are nearly 3,000,000 horses and 175,000 mules. With all the precautions to keep the cities sanitary little progress can be made so long as such an army of quadrupeds parade in endless procession up and down the city streets. The clouds of dust which sift above the pavements are not the clean earth of the plowed field, but are filled with disease germs and lingering death. The expulsion of the horse would mean the disappearance of the house fly by removing its chief breeding source.

It is apparent to all who have given study to the congestion of traffic in New York City that some change in the methods of delivery must be introduced. The board bill of the horses in New York amounts to $1,440,000 a year. The 120,000 horses hitched to vehicles in New York add a long and unnecessary line to the traffic parade. Counting eight feet from the dashboard to each horse's head, the animals take up 200 miles of the streets. If, for example, all the trucks and delivery wagons and carriages were hitched together with all the horses driven tandem before them, 190 miles of horseflesh would pass before the first wagon appeared in sight.

It is not an extravagant statement that every one of the 30,000,000 people living in American cities is put to unnecessary expense through the added cost of food, the combat against disease and the waste of time caused by the presence of more than 3,000,000 horses and mules in these centers of civilization. In an official report made by the Health Inspection of New York in 1864 attention was called to the unsanitary presence of swine in the streets. An ordinance was passed forbidding the keeping of pigs in the city and sheep and cattle were also denied the metropolis. No longer ago than last fall a westerner had to get a permit from the mayor to drive a team of oxen through the city.

When the railroad was introduced the horse was discarded as a motive power for long transportation. In a very few years the motor age will look back and laugh at the time when horses were permitted to spread contagion and death in the crowded streets.—*Mt. Union (Pa.) Times.*

Temporary lack of funds has caused the authorities of Indianapolis to refuse $5,800 for the purchase of a motor hose and chemical wagon and $2,500 for another motor police wagon.

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London Motor Cab Service.

Interesting particulars of the vehicles employed by the leading operating companies.

LONDON'S motor cab service is nearly five times as extensive as that of New York. Last July there were 3,394 machines licensed in the former city, of which number 1,700 were owned and operated by one company and its allies. Additions to equipment since that time make the present effective strength of this concern—the General Motor Cab Company—about 2,000 machines. It will soon own 3,500.

Two of the interesting features of London motor cab service are the unvarying rates and the freedom allowed the machines for picking up business. There are no special stands.

Although one or two feeble attempts to operate motor cabs in London were made as far back as 1898, when several electric vehicles were commissioned for west end service, it was not until the spring of 1907, when 70 Renaults were placed on the road, that their traffic was firmly established. From that date onward the number of machines has steadily increased, until today there are close to 4,000 of them, owned by twenty companies and over a hundred driver-owners. The bulk of these vehicles were supplied from European factories, although latterly British built machines have come upon the streets in large numbers.

* * *

The General Company commenced operations with Renaults. The greater part of its large fleet is still of this make. It also owns Unics, Darracqs, and Charrons, as well as British built Siddeley vehicles. The General and United companies recently installed a number of 8-10 hp. Charrons, one of which is illustrated. It is of high interest to know that the equipment of these two companies, which are allies, contains very few four cylinder vehicles, the majority of the fleet being equipped with low-powered two cylinder engines. These low-powered machines are very reliable and profitable for town work, but are not employed for long country trips. For this latter class of work the higher powered four cylinder vehicle is used. Country journeys are undertaken with great frequency by London motor cabs. A great demand exists for the company's 15-20 hp. Charron landaulettes, which form the private hire department, and which may be met all over the country. These machines are roomy, quiet and comfortable. The concern also owns a number of 8-10 hp. Charron models. They are excellent little vehicles, being able to negotiate a gradient of 1 in 7 with five passengers.

* * *

The Coupe Company, which operates about 1,500 machines, and the Motor Cab Company of Great Britain, Ltd., an allied concern, employ Napiers, and when their fleet is complete will have 3,000 of these vehicles. The national flag is painted on the door panel to indicate that they are British built in every particular. The Coupe Company, whose long established livery service is well known, runs the private hire section of the combined companies. It is extensively patronized by touring Americans. This concern first employed electrics, and still has some machines of that type in service. It relies mainly, however, upon the two Napier models, one a 10 hp. two-cylinder machine, and the other a 15 hp. four-cylinder type.

* * *

Among the most popular of the foreign machines in London are the vehicles run by the F. I. A. T. Motor Cab Company. This establishment owns over 400 12-16 hp. four cylinder vehicles which are exceedingly quiet and smooth travelers. Like its rivals, the F. I. A. T. Company has its private hiring department from which it operates over fifty 15-20 hp. landaulettes, and also a number of the 12-16 hp. type.

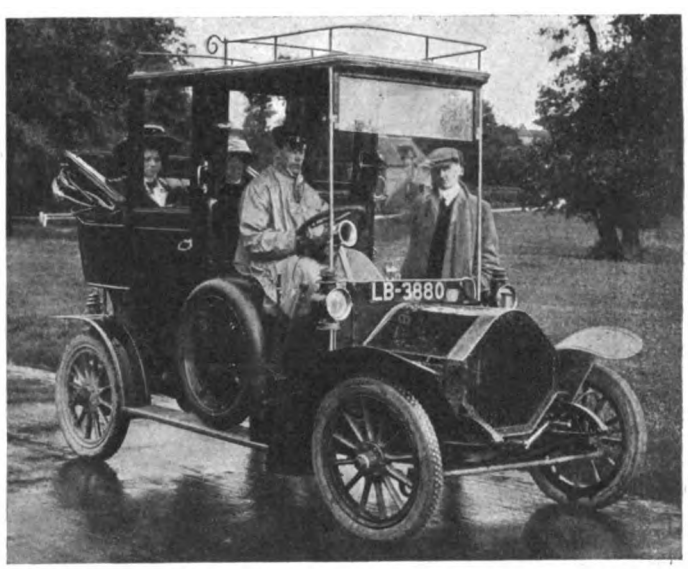
The De Dion Motor Cab Company has just been formed to operate vehicles of that make, while the Unic Motor Cab Company has been doing business for several months past.

* * *

The makers of the Humber are operating forty of their own cabs, while a large number of similar machines are being run by the Universal Motor Cab Company and by driver-owners. The machines run by the Humber firm are all of the 10-12 hp. four cylinder type. The Belsize is another British built vehicle that is used in large numbers. It operates sweetly and silently on the road. It is the mainstay of the Express Cab Company. The Express Company also own a few French Ballot cabs, as also do the Quick Cab Company. Argyll vehicles are used by two concerns—the Consolidated Cab Company, and the Meter Cabs Ltd. A few of these machines are driver-owned. Austin cabs of 10-15 hp. are being operated by a firm known as Urban Taxicabs, Ltd. The Marple is the only cab having the engine under the footboards.

* * *

All the motor cab companies have the same scale of charges, that is, 16 cents for the first mile or part there-



Two-cylinder 8-10 hp. Charron cab used in London.

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of, and 4 cents for each quarter of a mile thereafter. The charge is by time if the cab is waiting, or is going slower than six miles per hour, the taximeter registering 4 cents for every 2½ minutes. The baggage charge is 4 cents per package.

Drivers are paid at the rate of 25 per cent of the takings recorded by the taximeter, out of which they have to pay for gasoline at wholesale cost. The sum of 12 cents is also deducted for insurance each day, this latter being returned in the event of there being no accident caused by the driver's carelessness. For London it is reckoned that the receipts average $10 a day.

The drivers' wage having been deducted from the takings, there remains $7.50 to cover the cost of running the cab, and standing charges. About $3.75 is the actual running cost per vehicle, leaving $3.75 gross profit, from which management costs, standing charges and directors' fees have to be deducted, these, of course, varying in accordance with the size of the company and the organization of the garage.

ALDERMEN OPPOSE TAXICAB REFORM.

SOME of the higher officials of New York assert that the enforcement of the ordinance regulating taxicab rates and operation is being prevented by aldermen who are interested in the companies which control the vehicles.

The original ordinance, which is nullified by the refusal of the aldermen to pass the resolutions for the positions and salaries of the inspectors, compels the payment of an annual fee of $10 for each taxicab, and the driver must pay $2 a year for a license. The bureau of licenses is given full control over the business, including the right to inspect all meters. No cabs are to be allowed to run unless the taximeters are approved by the bureau. The rates are fixed as follows: Cabs accommodating two passengers, 30 cents for a half-mile or less, 10 cents for each additional quarter-mile, and $1 for each hour of waiting time. Cabs accommodating four persons, 40 cents for a half-mile or less, 10 cents for each additional quarter-mile, and $1.50 for each hour of waiting time. No charge is to be made for children under 5 years of age, or for suit cases, although 20 cents may be charged for each "piece of baggage."

The school commissioners of Indianapolis are considering the employment of motor wagons.

In slightly altered form the old electric police patrol and ambulance, formerly used in Hartford, Conn., is now employed by a farmer in the neighborhood in hauling produce to market.

In Asiatic Turkey a concession has been granted to a company which will operate motor wagons and buses between Beirut and Bagdad. The service of the machines will avoid the necessity for making a sea journey of 4,000 miles. The road distance between the two points is 525 miles.

WHERE MOTOR BUSES ARE NEEDED.

WHILE the operation of the limited franchise law has occasioned the retirement of many rail transportation projects in the state of New Jersey during the past three years, it has provided a situation which is peculiarly favorable for motor bus enterprise. Banks decline to touch the securities of companies formed to operate interurban trolley cars, and as a result many such undertakings have either been abandoned or else given such a twist as to make the use of road motors imperative.

Ten buses will soon be running between Elizabeth and South Amboy in the service of the Suburban Motor Transit Company. This equipment will absorb about $50,000 of the $100,000 working capital. For twelve years the business men of the district to be tapped by this service have been considering ways and means to provide much needed transportation facilities. No other section of the state, whose industrial development is well advanced, presents such poor accommodations for travelers as that which embraces Elizabeth, South Amboy and the adjacent territory. The lack of transportation conveniences is by business men regarded as a hindrance to trade, and hence they are only too willing to encourage the establishment of local motor bus service. While the Pennsylvania and New Jersey Central railroads operate an extensive service, they do not and cannot reach the new communities.

At least twenty efforts have been made to get rolley lines established over all or parts of this route. A trolley system from Elizabeth to South Amboy would cost about $600,000, and much time would be required for its establishment.

Those interested in the motor bus enterprise are: Edwin M. Simpson, of New York, son of ex-Judge Simpson; Maximillian Kahn, the New York banker; ex-United States Senator Richard F. Pettigrew; George H. Atkinson, of the G. H. Atkinson Company, Jersey City; Charles A. Trimble of Elizabeth, Clarence H. Winans of Linden, Joseph A. McClary of Rahway, and others.

The board of directors will be made up of merchants along the route. J. A. McClary has been chosen general manager, with headquarters at Rahway. The equipment will consist of 30-passenger machines fitted with 40 hp. engines. The company will also operate a motor cab service at all railroad stations in the territory.

The trustees of the Grady hospital in Atlanta, Ga., are considering the purchase of a motor ambulance.

The St. Louis Taxicab Company has reduced its rates. Four passengers can now ride a mile for 40 cents. Formerly this was the charge for a single passenger.

The purchase of an $8,000 motor hose and chemical wagon is being considered by the members of the Reliance fire company of Wilmington, Del. Members of the Water Witch fire company are also inclined to buy a machine.

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Road Administration Methods

Comparison of home and foreign systems of maintenance—European methods very costly.

BY L. W. PAGE, Director of Public Roads, Washington, D. C.

THE present road situation in the United States may be briefly summed up as follows: •In mileage we have the most tremendous system of roads which any country has ever possessed since the world began. According to a careful road census, the length of all of our roads amounts to 2,155,000 miles. The most liberal estimate of our annual expenditure on these roads, both in money and labor, was a fraction over $79,000,000 in 1904, or about $1.05 per capita. At the same rate this would be an expenditure of about $90,000,000 at the present time. England, with only 150,000 miles of road, spends about $80,000,000 a year, or about fourteen times as much per mile.

According to our road census we have less than 40,000 miles of stone surfaced road, or about 2 per cent of the total mileage; we have 108,000 miles of gravel road, or about 5 per cent of the total mileage. Small as our annual expenditure for roads has been, it has aggregated, during the 30-year period from 1870 to 1900, a total of upwards of $1,800,000,000. We may, therefore, say that road building in the United States is, considering area, population and wealth, at the same point at which it stood 30 years ago, and the seventeen hundred and odd million dollars have produced few appreciable results.

* * *

Obsolete Methods of Administration.

When we turn to the subject of road administration we find about half of the states are operating under practically the same road laws as prevailed in England when America was a colony. This system of road administration provides for the payment of road taxes partly in labor, and localizes the work to an extreme degree, by placing in authority the district or township road overseers, or road supervisors, no requirement being made to insure skill or knowledge of road building on the part of these petty officials. With few exceptions no system of accounting is in force so that an intelligent idea may be obtained as to the disposition of the road tax, and no definite lines of authority are established such as would guarantee the wise and equitable conduct of the work.

This is a system which prevailed in all the states until less than 20 years ago. It is, therefore, easily understood why, at the present time, the concrete results in the matter of road building are so few, are confined to a comparatively recent period and are located in those states which have broken away from the inadequate and ineffective system which I have just described. It can also be understood why, at the present time, road work in those states that have clung to the old methods and the old system is conducted in a wasteful, intermittent and wholly ineffective manner, productive of no good results.

* * *

State Aid and Supervision.

Road administration has either been placed on a sound and practical basis, or steps taken in that direction, in about half of the states of the union, comprising the New England states, New York, Pennsylvania, New Jersey, Delaware, Maryland, Virginia, West Virginia, Ohio, Michigan, Illinois, Wisconsin, Minnesota, Missouri, Kansas, California and Washington. These states have adopted in principle or practice, or both, the system of centralizing under a state highway department the conduct of all or part of the road work of the state, thereby securing uniformity in methods, economy in administration and skill in supervision. In some of the state highway departments the work is educational and investigative, with a view to ultimately giving these departments administrative powers. Some of the states, notably Kansas, Missouri and West Virginia, have provided for skilled supervision in the counties, through the appointment of county highway engineers. In most of these states appropriations have been made from the state treasuries, or the aid of the state convict force has been given toward carrying on road work throughout the various counties.

It is not possible in a short paper to enter into a discussion of the various systems of state aid in effect in this country. Suffice it to say, that the principle of state aid and supervision constitute the germ of the only road administration which has proven successful in other countries. This movement is gaining headway at a very rapid rate, and when we consider that it has been little more than a decade and a half since its inception, the fact that half of the states have adopted it in principle, and have actually expended from state treasuries considerably over $56,000,000, we may well feel encouraged for the future of road building in this country.

* * *

France's Remarkable Administrative System.

The striking feature of the French road system is the skilled supervision provided in every grade of road work and in every unit of the administrative organization. The basis of the system is the school of roads and bridges, one of the finest technical schools in the world, maintained at the expense of the national government. In this school are trained the highway engineers to whom are intrusted the building and maintenance of the roads of France. The course of study lasts 3 years and the instruction is free.

At the head of the administrative organization is an inspector-general of bridges and highways, under whom are chief engineers in charge of the road work of single departments and communes. Single arrondissements are under the direction of ordinary engineers and under engineers, the latter being equivalent in rank to non-commissioned officers in the army. The subdivisions are under the direction of principal conductors and ordinary conductors. Next in line come the foremen of construction gangs, the clerks employed at headquarters, and finally the cantonniers or patrolmen, each having from 4 to 7 kilometers of highway under his immediate supervision. This great administrative machine, working in complete harmony with definite lines of responsibility clearly established, accomplishes results with the precision and regularity of a great clock ticking off the seconds of time. Probably the most important unit in this great army of workers is the cantonnier, or patrolman, who has charge of a single section of the road. He keeps his ditches open, carefully fills holes and ruts with broken stone, removes dust and deposits of sand and earth after heavy rains, trims the trees and bushes, and when ordinary work is impossible he breaks stone and transports it to points where it is likely to be needed. He brings all matters requiring attention to the notice of his chief. Each cantonnier carries a little book in which the chief cantonnier notes his instructions and checks up the work accomplished. The conductors go over the line at regular intervals and direct the chief cantonniers, and all reports are transmitted to the central authorities, so that any day or any hour the exact condition of every foot of road throughout France may be ascertained. Every year the conductors prepare estimates of necessary expense for the next year, under three heads, namely, maintenance, heavy repairs and new work, and the parliamentary appropriations are based upon these careful calculations.

There are in France at the present time 23,656 miles of national routes, which cost $303,975,000 to build. There are 316,898 miles of local highways built at a cost of $308,800,000, of which the state furnished $81,060,000 and the interested localities $227,740,000. The roads of France are classified into five classes: First, national routes, traversing the various departments and connecting important centers of population; second, the depart-

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ment routes connecting the important centers of a single department and bisecting the national routes; third, highways of grand communication little less important than the previous class; fourth, highways of public interest traversing a single canton and connecting remote villages and groups of houses with the more important roads. Thus it will be seen that France has the idea well systematized.

* * *

Road Maintenance in England Is Costly.

There are at the present time 149,759 miles of road in England, from which the annual expenditures for the year 1905 to 1906 amounted to $78,059,000. It is, therefore, evident that the annual expenditure per mile of road amounts to about $520. In view of the fact that most of the principal roads of England have already been constructed, this large annual expenditure would appear to be devoted in a large measure to maintenance. It would seem that a system which required an annual outlay of $520 per mile for the entire mileage must be ineffective and costly. The explanation of this is found, perhaps, in the fact that in England the maintenance of the public highways devolves entirely on local authorities, these numbering about 1,900. Jurisdiction over the roads is vested in: First, the county boroughs; second, the county councils; third, the urban district councils; fourth, the rural district councils. The county boroughs are certain large towns which hold charters from the crown entitling them to the privilege of self government. In these the maintenance of the highways devolves entirely upon the borough or town council. In counties the maintenance of highways devolves upon urban councils in the urban districts, and rural councils in the rural districts. The only exception to the control of the urban and rural district councils is in the case of main roads which are highways between great towns, and the maintenance of these roads devolves upon the county councils.

Revenues are provided by district taxes except for the main roads, for the maintenance of which a county levy is made. The national government aids in the maintenance of the highways by a contribution proportioned to the sum raised by the imperial taxation levied in the different areas.

As to skilled supervision it may be said that no qualifications are required by law to be possessed by the men in charge of road building and maintenance, but it is the general practice in the important districts to appoint experienced highway engineers for this work. The English system lacks strong central control in each county, there being four different classes of government units, namely, the county boroughs, the urban districts, the rural districts and rural parishes. Although the county council exercises some control over the rural districts and the rural parishes, they exercise none over the other two units.

* * *

Germany Has Many Systems.

Germany is a federation of states, and it follows that road administration is conducted separately by each state of the empire. The imperial government exercises very little control over the highways, and does not in any way contribute to the expense of their construction and maintenance. The kingdom of Saxony may be taken as a representative state of the German empire. In Saxony the highways are divided into state roads, country roads and private ways. The state roads comprise those which have been built by the state and are maintained by the state. The county roads are generally termed communicating roads, and are built and maintained at the expense of the parishes through whose territory they lead.

A striking feature of the Saxon road system is the practice of planting fruit trees along the roads, the fruit yielding a considerable revenue. About $40,000 a year is obtained from the fruit grown along state roads, and the amount obtained from the country roads represents a much larger sum.

The state roads are cared for by a commission of engineers. The kingdom is divided into seventeen road districts, in each of which there is a road inspector. Under these inspectors are road masters, who are employed constantly throughout the year. Each road master has about 37 miles of road under his direction, and a road force of about fifteen men, each man caring for 2½ miles of road.

In the case of the minor roads, the direct responsibility is borne by the authorities of the county. They levy the cost of maintenance and collect the revenues. The communities engage the road employees for the continued care of the highways. The technical supervision, however, is exercised by the road masters of the state force. Strict provisions are made requiring skill and special knowledge before road officials are appointed.

* * *

Swiss Roads Are Under Individual Canton Control.

The road system of Switzerland is local in character; the various cantons having jurisdiction over the roads within their respective borders. The roads are classified into state roads—built and maintained at the expense of the respective cantons; community roads—built and maintained by the communities; and side, or auxiliary roads, connecting main lines of state or community roads.

Each canton has at the head of its road system an engineer with capable assistants. In the canton of St. Gall, which may be taken as representative, there are under the control of the engineers five inspectors or road masters, who are assigned to certain districts in the canton. The engineers and their assistants must have an academic education and possess a diploma from the Polytechnic Institute, and the road masters are required to have a good technical education.

* * *

Skilled Supervision a Characteristic of European Administration.

It is apparent from the foregoing that although the units of administration in European countries range all the way from the localism of England to the highly centralized system of France, through varying degrees, skilled supervision is provided by all of the systems, as well as an ample cash revenue sufficient to enable the engineers to carry out adequately their plans for improvement and maintenance. England is the most striking example of extreme localization, and it is a significant fact that England is also the most striking example of lack of uniformity in road work and of excessive expenditure in proportion to mileage. It is also significant that the most perfect road system, conceded to be such by all authorities on highway construction, is that of France, admittedly the most highly centralized of all the road systems. France, with a total mileage of about two and one-third times that of England, expends about the same amount annually for maintenance. Certainly, the inference must be plain that centralizing makes for economy and efficiency in the administration of the public roads.

* * *

European Maintenance Cost Is Very High.

I desire to comment particularly upon what I consider to be the most important point which should engage the attention of American road builders and legislators at the present time, and that is road maintenance. In the years that have past by far the largest portion of our annual expenditures has been for maintenance of our unimproved roads, a maintenance which may justly be considered a mockery, for it has been a maintenance of the roads in almost their primitive condition. Now that we are actually building roads which compare with the best of Europe, it is of the gravest importance that we make provision for safeguarding and maintaining these roads built at so great an expense.

In a careful study of the highway laws which have been enacted within the past 15 years, I find almost no provision for the maintenance of the roads, although large sums are authorized for construction. The erroneous impression generally prevails that when a so-called permanent road is constructed it is there for all time, and the expense has practically all been met. I have investigated the cost of maintaining roads in the leading European countries, and the figures may almost be said to be a revelation. In 1901 England and Wales maintained 26,598 miles of main roads at a cost of $370.34 per mile. In 1907 England

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and Wales maintained 27,556 miles of main roads at a cost of $446.74 per mile, or, in 6 years, the cost of maintenance had increased $76.10 per mile—an increase of over 20 per cent. In France the increase in cost of maintenance of the national roads has been about 5 per cent in the same period. The cost of maintaining main and suburban roads in England and Wales in 1905 and 1906 was $440.47 per mile. In France the cost of maintaining all roads during 1904 was $243.33 per mile. While these last figures are not strictly comparable, one being for 1904 and the other for 1905, yet the mere fact of one year's difference in time fails to explain the difference of $197.14 per mile in cost of maintenance—the natural inference being in favor of the superiority of the French system. In Germany in 1906 the average cost of road maintenance was $214.13 per mile. In Belgium the annual cost of maintaining the provincial roads is $277 per mile.

* * *

French System Appears To Be Best.

These figures express most forcibly two facts: first, that even the best of improved highways are not self-maintaining; second, that the cost of maintenance varies tremendously with the degree of centralization of the administrative organization which has the roads in charge. France with its most highly centralized organization is maintaining her roads at about 54 per cent of what it costs England and Wales with a very local and loosely centralized organization. Furthermore, the alarming increase in the cost of maintenance has been far more rapid in the countries with local and poorly organized systems of highway administration. We have just seen that although the rate of increase in maintenance from 1901 to 1907 in England and Wales was over 20 per cent, it was only about 5 per cent during the corresponding period in France. In England the maintenance is often intermittent and varies with the ideas of the local administration units; in France the maintenance is continuous and highly specialized.

* * *

The Economic Maintenance of American Roads.

Many of our states have spent and are spending large sums of money on their highways with but little thought or provision for maintenance. This, if the experience of European countries is of any value, must prove disastrous in two ways. First, granting that the roads constructed at so great cost will not be allowed to go entirely to ruin, the cost of maintenance will be higher the more local and loosely centralized the organization for maintenance; and, second, systems of intermittent maintenance are sure to increase in cost from year to year as they have in Europe. It is high time that our legislatures take note of these facts and provide ways and means so that our roads once constructed can be maintained efficiently and economically and not allowed to go to ruin, and that exorbitant sums need not be expended on fruitless efforts to maintain them unsystematically and in an unscientific manner.

It must also be evident from a study of expenditures in Europe that our road revenues are entirely inadequate. Although $80,000,000 seems a large sum, it is only about $38 per mile to meet all new construction, bridge building and every class of maintenance. We need, and must have, more money for roads, definite provision for maintenance, a system of continuous repair and a centralized, skilled supervision.

The Kansas City Rapid Motor & Transportation Company was recently organized in Kansas City, Mo., with capital stock of $50,000.

On the first of October there were 960 motor buses operating in London. The highest number in commission for any one month of the present year was 1,075, which was reached in July.

MACADAM ROADS CONDEMNED.

SPEAKING before the delegates to the national good roads convention, recently held in Cleveland, Ohio, the chairman of the New York state highway commission expressed his disapproval of macadam roads for motor traffic of all kinds. He said:

"Macadam roads are showing day after day that they are incapable of withstanding the wear and tear of motor cars and trucks. It is difficult to say what construction or process makes the most durable state of highway, but in my experience I have found that the surface of the road gives the best results when it is composed of a mixutre of coarse stone, such as the foundation of the road is made of, together with viscous material, such as oil, containing from 85 to 90 per cent of asphalt. It is absolutely useless to continue macadam roads with the fine material top dressing used at present, because, although this will withstand ordinary 10 and 12-mile-an-hour horse traffic, it is entirely inadequate for motor use. The sooner road builders get away from the hallucination that they can build macadam roads for $2,000 a mile the better. This is impossible and a foolish waste of money. Another fallacy of the road question is that all building of highways must be done directly by the state or national government. The best results always have been obtained when the road work has been done by local officials backed by state advice and funds."

HUMANE SOCIETY FAVORS USE OF MOTORS.

OFFICERS of the Humane Society in Cleveland, Ohio, have declared for the motor wagon against the horse for heavy city hauling. Local statistics show that horses fresh from the farm are in wretched condition after three years' of work on the hard city pavings, and then are sold to peddlers and draymen who mistreat them.

Dr. Friedrich, the local health officer, expresses the hope that he will see the time when all heavy hauling will be done by motors, leaving less arduous work to the horse.

Portsmouth and Harrisonville, in Ohio, are to be connected by motor bus.

The purchase of two pieces of motor fire apparatus has been authorized for service in Worcester, Mass.

The volunteer firemen of Cold Spring Harbor, L. I., are raising money for the purchase of a motor hose and chemical wagon.

A motor police wagon will soon be installed in Camden, N. J., the council having advertised for bids. The machine is to be equipped for ambulance work.

One of the motor cab companies in London has decided to allow all drivers and repairmen who have been employed in its service for more than two months to participate in the profits of 10,000 shares of stock.

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MOTOR STREET SPRINKLERS.

THE street commissioner of Toronto is urging the purchase of two motor sprinklers at a cost of $9,000. His opinion of their economy is thus expressed:

"If we do not get the motors we will have to buy more horses in order to do the street cleaning for the extended area of the city, and that would mean more stables and greater cost of maintenance. I consider this a first-class business proposition. The water tanks can easily be taken off the machines, and boxes put in their places, and the machines then could be used for hauling ashes and heavy garbage."

LONDON MOTOR BUS SPECIFICATIONS.

THE police authorities of London, having authority to control and regulate motor bus traffic withhin the metropolitan area, make full use of their power, even influencing the design of the machines in many important particulars. According to the latest regulations vehicles carrying 34 passengers must be so constructed that they will not weigh, unladen, more than 7,000 pounds. The total weight, laden, must not exceed 6 tons, allowing 140 pounds for each passenger. Manufacturers, if they prefer, may distribute this weight as follows: 4 tons on the rear axle and 2 tons on the front axle. If the weight is not distributed in this portion it must be so distributed that undue stress is not thrown upon the front. Nor must the maximum of 6 tons be in any case exceeded.

These rules for weight distribution only apply to gasoline machines, the design of the electric bus not yet having been officially considered.

MOTOR MAIL WAGONS IN PHILADELPHIA.

FOUR motor wagons are employed in the collection of mail matter in Philadelphia. They have superseded nine horse-drawn vehicles. The machines are leased at an annual rental of $3,000 apiece, the service of the drivers included. Only the western and northern sections of the city are being thus served.

The board of managers of the Philadelphia Society for the Prevention of Cruelty to Animals has decided to buy an electric ambulance.

Fifteen motor cabs have been put in commission in Jacksonville, Fla. The equipment will soon be increased to 35 machines.

The health authorities of Newark, N. J., have succeeded in getting an appropriation of $2,700 for the purchase of a motor ambulance.

CANTILEVER SPRING DESIGN.

AMONG the advantages claimed for the spring design shown in the accompanying illustration are prolonged tire life and reduced expense of maintenance in engine and working parts of a vehicle to which it is fitted. The spring action is the reverse of that obtained by the use of laminated springs of ordinary design, the load being carried horizontally instead of vertically. With each set of springs a saddle is furnished, to be placed on the spring seat of existing vehicles. The bolt holes, which are used to fasten the ordinary spring clips, are in this device used

with four short bolts to fasten the saddle. The springs are constructed to take any desired arch. They operate the moment the first pound of load is placed on them. It will be observed from the drawing that inside of the compression is another compression spring of similar size to take up throw or rebound.

The leaf springs or arms act merely as a bell crank hanger to carry the whole weight to the compression spring. If, however, an overload should be carried that would compress the carrying spring entirely there is present a resilient means in the arms for preventing the load from going down. An adjustment screw is placed at each end of the compression spring in case a spring becomes weak or the arms become straightened and the vehicle body drops down. These screws have an adjustment of three inches. The design shown is for light load and fast moving vehicles. For slow moving vehicles with large load capacity substantial solid arms are used instead of laminated spring arms.

LATE TYPE OF MOTOR BUS.

CONFORMING to police regulations affecting the design and operation of motor buses, one of the largest operating companies in London is about to commission a number of new 34-passenger machines which will be equipped with 30 hp. engines and old style ignition. Sliding gear transmission, cone clutch with laminated springs, worm gear for final drive, and steel wheels are features of the construction.

A motor hose and chemical wagon has been ordered by the council of Middletown, Conn.

Fleet of electric wagons used in mail service of New York City.

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STEAMERS TO REPLACE OLD GASOLINE BUSES.

STEAM as a substitute for other power agents in the propulsion of old and unsatisfactory gasoline buses is under consideration at the hands of the London General Omnibus Company. The first motor buses ever put on the road were steamers. They were not models of lightness in design. Very many years have passed since then, but for some unexplained reason designers, until about two years ago, were unable to turn out anything but a cumbersome looking vehicle. The gasoline bus led the way. When designers decided to put the boiler under the bonnet, and the engine in the place of the gasoline bus gear box, or thereabouts, then only could it be claimed that a steam bus was as good to look at as a gasoline vehicle. It is strange, indeed, that steam bus designers did not earlier recognize the possibilities of lightening their vehicles by carefully mounting the flash boiler.

The London General company has had a gasoline chassis adapted to a steam drive. To outward appearance the adapted machine looks like an ordinary gasoline bus. The reason for the change is interesting. It is not that steam buses are cheaper to operate than gasoline vehicles, because they are not. What, then, is the reason? Is it because steam buses are cheaper to maintain than gasoline vehicles? No; but steam engines have fewer delicate parts and are less racked by stopping and starting strains than are gasoline buses; they consequently require less garage attention. Tires, also, are punished less on steam than on gasoline buses.

Careful observation by the London bus companies of the cost of running their existing gasoline and steam buses shows an advantage in favor of the latter. Steam bus generators are a continual source of trouble, and require constant attention and very frequent renewal. Notwithstanding this difficulty, there is less trouble keeping a steam bus on the road in good condition than one of the gasoline type, unless the latter is of an exceptionally good design. Gasoline buses are always requiring renewals of gears, either speed or differential. They cost less by 2 cents per mile to run on the road than steam buses, but cost more by 4 cents per mile to superintend in the garage. Therefore the steam bus, even in its present expensive condition, costs less to operate, supervise, and maintain than the gasoline type.

HOW ONE CONVERT WAS SECURED.

DRAFT animals are worth more money in a trade or at forced sale today than they will be when the motor wagon movement gathers greater headway. The owners of such property do not sufficiently appreciate the truth of this observation. They are often deterred from considering the purchase of machines by fear of the loss which might arise if they failed to sell their present inadequate equipment to good advantage.

Despite the progress which is being accomplished in motor wagon transportation horses and horse equipment are in strong demand at good prices. This, however, is not due to any superiority of the latter. It is wholly attributable to the growth of commerce and the urgent need for traffic auxiliaries of all kinds. The situation will be strikingly different when motor wagon production is facilitated and the wants of buyers can be more promptly relieved than is the case today. When that period arrives —and it is not very distant—draft animals will be nearly as cheap as sheep.

Few possess a nicer appreciation of the present-day worth of a horse than the representatives of firms producing motor wagons. This was well proved in a recent transaction in Council Bluffs, Ia., which resulted in the sales manager of the Chase Motor Truck Company turning a neat trick. To call a bluff, clinch a trade, and show his confidence in the exchange value of draft animals, Mr. Durphy agreed to accept a horse and wagon in part payment for a machine. To dispose of the horse outfit he paraded it on the principal streets, the animal covered with a cloth sign announcing that it had been superseded by a motor wagon which would do more work, at less cost, in one day than could be accomplished by the horse outfit in three days. In a short time Mr. Durphy got rid of his newly acquired property, realizing $25 more than it was valued at in the trade.

Regular motor bus service has been established between Lubbock and Brownfield, Tex.

Motor buses capable of carrying 35 passengers are operating between Milton, Fife, Brookville and Tacoma, Wash. Later a motor freight service connecting these points will be established.

Horse outfit that figured in a motor wagon sale.

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DISTRIBUTING HIGHWAY SIGNS BY MOTOR.

ONE THOUSAND enameled iron signs, measuring 2½ feet in length by 1 foot in width, and weighing 4 pounds apiece, are being distributed between Atlanta, Ga., and Roanoke, Va., along the course of the national highway which extends from New York to Atlanta. The distribution of these signs, as well as the iron posts to which they are attached, is being accomplished by means of a specially equipped two ton gasoline wagon furnished by the Southern Commercial Motor Car Company of Atlanta, which is the local distributing agent of the Rapid company. The posts are 12 feet long and weigh about 40 pounds apiece. Two hundred of these posts are to be placed between Atlanta and Roanoke.

The machine is equipped with a powerful searchlight, crow-bars, pickaxes, shovels and other appliances for digging holes and erecting signs and posts. The first load of the machine consisted of 300 signs and 25 posts. The remainder of the signs and posts were shipped to convenient distributing points from which the machine will obtain future loads. The length of the route is 560 miles.

TRACKLESS TROLLEY BUS SERVICE.

RAILLESS trolley bus service will be established in Sterling and Rock Falls, Ill., if the councils of these places will give authority for the enterprise. It is planned to operate several vehicles which will carry 21 passengers. The service will feed the rail transportation systems now established in both places, acting as a connecting link between them. The rail transportation companies have agreed to install the required overhead construction.

A motor hose and chemical wagon, costing $6,500, will soon be installed in Houston, Tex.

NEW MODELS OF LIGHT RATING.

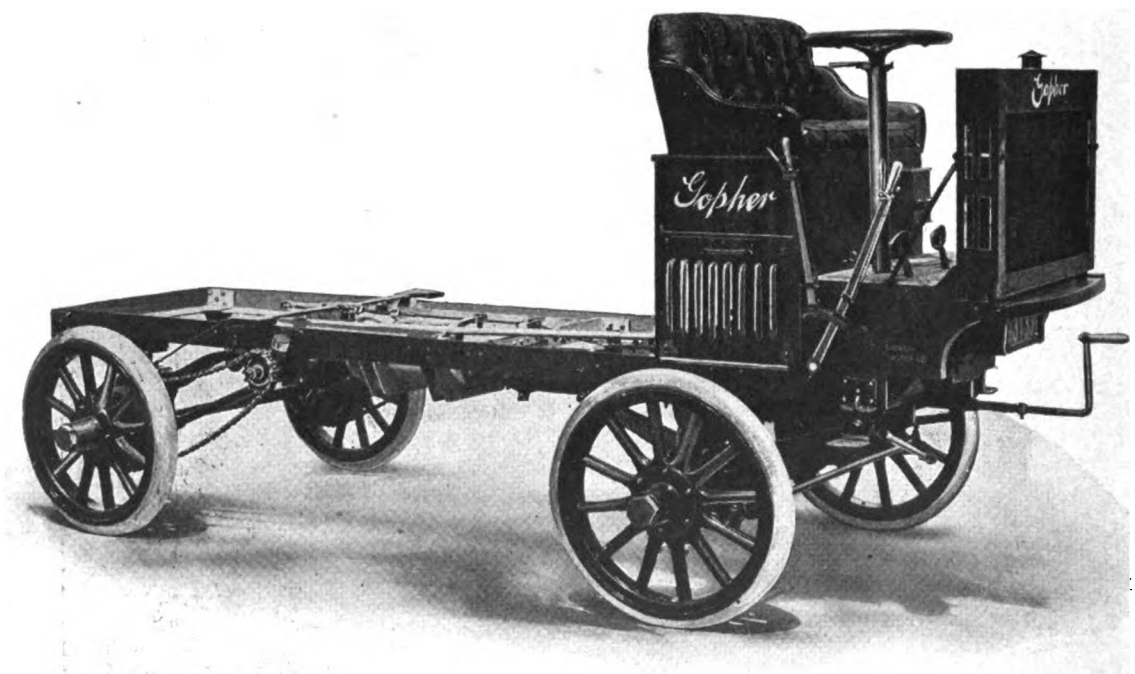
GAS driven vehicles of one and two ton rating are being made in Minneapolis by the Robinson-Loomis Motor Truck Company. They are fitted with vertical, valveless, double action engines of 22 and 30 hp. respectively. The transmission is of the sliding gear selective type, with three forward speeds and reverse. Final drive is accomplished by means of side chains. Wheels of 32 inch diameter are fitted to the one ton model and wheels of 34 inch diameter to the machine of higher rating. The standard wheel base for both models is 98 inches. The front axles are of the I-beam pattern, equipped with roller bearings. The rear axles are square and similarly equipped.

The individuals of which this firm is principally composed are well known in the commercial motor vehicle industry, Mr. Robinson, the president, having for several years past been exclusively engaged in the sale and manufacture of such machines, while Mr. Loomis was formerly sales manager for the Reliance Motor Truck Company.

NEW COMPANY ELECTS OFFICERS.

LAST month the incorporation of the United States Motor Truck Company, of Cincinnati, was announced. The capital stock of the company is $100,000. Three gasoline models, of one, two and three ton rating, will be produced. The following officers have been elected: President, Alfred Hill; vice president, Herman Erdman; treasurer, Harry L. Manse; secretary, Jesse Lowman; directors, J. B. Orr and the four officers; executive committee, Alfred Hill, Harry L. Manse and Jesse Lowman.

The business men's association of Northwest Baltimore is urging the purchase of a motor police wagon.



Two-ton machine made by Robinson-Loomis Motor Truck Company.

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SOUTHERNERS TO PRODUCE MACHINES.

PREPARATIONS are being made for the production of commercial motor vehicles in Birmingham, Ala., by the Great Southern Automobile Company. This concern, capitalized at $100,000, is managed by the following officers: E. F. Enslen, president; Isaac Adler, vice president; John Kyser, secretary and treasurer; E. F. Enslen, Jr., general manager.

TO MAKE MORTUARY VEHICLES.

THE Metropolitan Automobile Works, of Chicago, has been organized for the manufacture of motor hearses and such other motor-driven vehicles as may be used by undertakers The production of motor ambulances will be specialized.

WILL PRODUCE IN HARRISONVILLE, MO.

THE Solax Auto Truck Company of Kansas City is the title of a concern which has been organized for the production of machines in Harrisonville. Mo. The selling of the product will be conducted from Kansas City.

TO MAKE MACHINES IN FORT WAYNE.

MOTOR wagons will be built in two sizes by the Ideal Auto Company, of Fort Wayne, Ind., a newly organized concern of which Arthur B. Hall is president, F. K. Safford, secretary, and Max Blitz, treasurer.

TO BUILD IN KEYPORT, N. J.

THE Commercial Car Company of Keyport, N. J., has been incorporated with capital stock of $125,000. The charter of the organization authorizes the manufacture of motor road and rail vehicles.

WILL BUILD VEHICLES IN BUFFALO.

THE Riverview Bronze and Manufacturing Company has been incorporated, with capital stock of $50,000, to manufacture commercial motor vehicles, in Buffalo. No details of design are yet available.

WILL EMPLOY NO AGENTS

THE Vogel Car Manufacturing Company, of St. Louis, Mo., has been incorporated with capital stock of $75,000 for the production of commercial motor vehicles which will be sold direct from factory to user. The president of the company is H. L. Vogel, who was formerly connected with the St. Louis Car Company and the Danville Car Company.

The fire authorities of Council Bluffs, Ia., are urging the installation of a motor hose wagon.

The sum of $4,000 has been appropriated for the purchase of a motor police wagon for Johnstown, Pa.

The chief of the fire department in Macon, Ga., advocates the use of motor hose wagons.

A DEAL THAT FELL THROUGH.

THE following communication from the Washington Motor Vehicle Company is in answer to the statement of the Pittsburg Motor Vehicle Company which recently appeared in this journal:

"To the Editor—To clear up the 'correction' which appeared in your September issue over the signature of the Pittsburgh Motor Vehicle Company, please note the real facts.

"Mr. R. B. Ward, president of the Pittsburgh Company, expressed a desire to sell the entire company if W. H. Conant, at that time general manager, would raise the necessary money. Because of certain conditions his proposition was not considered by the gentlemen who became interested, and a verbal agreement was reached to buy the name and good will only. On this basis a company was formed in Washington, D. C., and incorporated under the West Virginia laws as the Pittsburgh Motor Vehicle Company, all in accordance with the previous arrangement between Mr. Ward and ourselves. When it came to signing and paying the deal fell through, and we immediately changed our name to its present form.

"The Secretary of State of West Virginia in the meantime had given out the name of the new company to the newspapers. This is the entire basis of the indirect accusation in your published 'correction.' Permit us to say that all these facts were familiar to the company which tried to advertise itself at our expense."

WASHINGTON MOTOR VEHICLE COMPANY.

ALDEN SAMPSON COMPANY'S SALES ENGINEER.

THE Alden Sampson Manufacturing Company, making motor trucks and gas-electric road trains in Pittsfield, Mass., has secured the services of R. S. de Mitkiewicz, member of the gas power section of the American Society of Mechanical Engineers and formerly with the Fairbanks Company. Mr. de Mitkiewicz will be located at the company's New York office, 115 Broadway, as sales engineer in mechanical transportation.

TWO TIRE CATALOGS.

TWO new tire catalogs have just been issued by the Diamond Rubber Company. One illustrates and describes the wire mesh base tire for commercial motor vehicles of every description, as well as the side wire type. Both types are manufactured in single and twin form. Particular attention, however, is called to the simplicity of the wire mesh base type, which can't fly off, but can be removed and applied easily without the aid of machinery. The other catalog describes and illustrates tires for high wheel motor vehicles.

The authorities of Fresno, Calif., are considering the purchase of a $7,500 machine for the fire department.

Money is being raised among the citizens of Anniston, Ala., to partially defray the cost of installing a motor hose wagon.

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Even the little town of Caspar, Wyo., with a population of but 1,000, is completing arrangements for the installation of a motor hose and chemical wagon.

The fire chief of Charleston, S. C., having witnessed the work of the Augusta, Ga., motor hose and chemical wagon, has decided to ask the executives of his city to vote money for the purchase of such a machine.

The council of Newark, N. J., has voted $2,700 for the purchase of a second motor ambulance for the health department.

The citizens of Santa Ana, Calif., are being solicited for funds to purchase a motor hose and chemical wagon. The city authorities are without money for the purpose.

In order to provide adequate protection for the suburbs of San Antonio, Tex., the fire chief recommends the purchase of a motor hose and chemical wagon.

The Hudson Taxicab Company has been organized in Scranton, Pa., with a capital stock of $50,000.

The Union Auto Transportation Company has been formed in Cohasset, Mass., with capital stock of $100,000.

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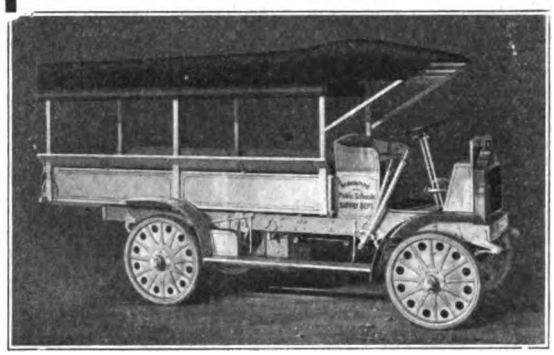

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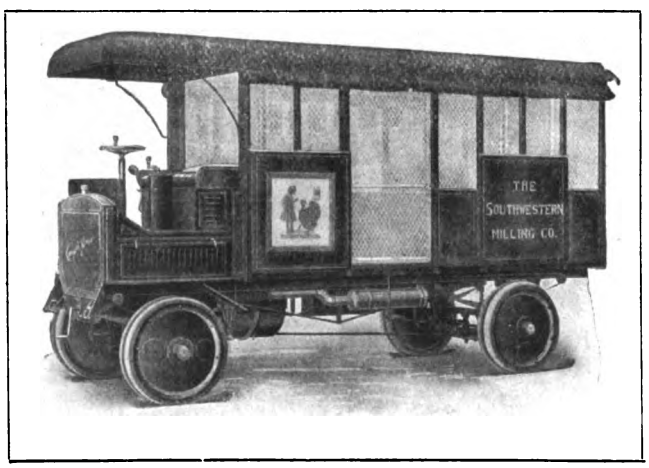

ALL four wheels of these machines are driven and steered. The trucks represent the most efficient design yet produced, showing a loss of less than three per cent from the driving member to the driven member.

¶ Their economy and reliability in service is very remarkable, due to the low expense of mechanical upkeep occasioned by the absence of parts which cause trouble.

¶ No clutches, change-speed gears, differentials, sprockets, chains or live rear axles, and no frictional surfaces.

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The Power Wagon

A Journal for Those Employing Commercial Motor Vehicles

No. 61 **DECEMBER, 1909** **No. 61**

PUBLISHED THE FIRST OF EVERY MONTH BY

THE POWER WAGON PUBLISHING CO.

SUBSCRIPTION RATES:

One Year (Domestic)	$2.00
One Year (Foreign)	3.00
Single Copies	.20

PUBLICATION OFFICES:
THE METROPOLITAN BLOCK
Chicago, Illinois.

Advertising Rates on Application

WALTER WARDROP, Editor

Entered as Second-Class Matter December 2, 1907, at the Postoffice at Chicago, Ill., Under the Act of Congress on March 3, 1879.

Pneumatic Shod Light Wagons.

Franklin company's engineer declares such equipment is superior in all respects to solid tires.

IS a light load gas wagon equipped with pneumatic tires more economical and dependable in service than a vehicle of like type and rating whose wheels are shod with solids? The engineer in charge of the Franklin company's motor vehicle department unequivocally declares in favor of the former equipment, urging the following arguments in support of the substitution:

1. Pnuematic tire cost per mile is about the same or a little greater than solid tire cost.

2. Earning capacity of the vehicle is increased about 50 per cent when equipped with pneumatics.

3. Depreciation of the vehicle is decreased about 50 per cent when air tires are used.

4. Pneumatic tires decrease the repairs to vehicle mechanism about 50 per cent.

5. Pneumatic tires wonderfully increase the reliability of the vehicle.

* * *

The use of pneumatic tires on machines employed in fast delivery service is not a novelty. In the past, however, such equipment has been more frequently dictated by expediency than commercial or engineering considerations. The truth is, the majority of delivery wagons fitted with pneumatic tires are in reality only converted touring cars, whose design is utterly unsuited for equipment with solid tires. It is seldom that one sees pneumatic-tired gas wagons which have been so mounted with deliberate engineering intention. The most conspicuous examples of such practice are to be found on some of the light models manufactured in France, a few of which are sometimes furnished with twin pneumatics on the rear wheels.

Before passing to an examination of the reasons advanced for equipping light wagons with pneumatic tires it will be instructive to consider the cost of maintaining such equipment on motor cabs, the traffic of which, with the exception of loads, is very similar to that encountered by light business machines. Both types operate extensively over paved and unpaved streets. Both travel at about the same rate of speed, varying from the legal rate of fifteen miles an hour to eighteen or twenty, according to the inclination of the driver or the opportunities afforded by traffic. Both yield a high daily mileage. It is well known, however, that the cost of pneumatic tire upkeep for motor cabs is in excess of two cents a mile. The most extravagant administration of light motor wagons could hardly succeed in making the cost of solid tire service exceed one cent a mile. If this is true—and there is plenty of evidence to confirm it—then the use of pneumatics must be justified upon some other basis than that of actual economy, for the mechanical repair expense of light, solid-tired machines can only by a stretch of the imagination be considered as 100 per cent greater than the like expense of pneumatic tired vehicles of equal work capacity.

* * *

"In the operation and manufacture of motor trucks," says the Franklin company's expert, "the great question is the cost of maintenance and upkeep. This subject is of greater importance than reliability; indeed, reliability is actually involved in it. For example, it would be possible for us to conceive of operating a motor truck which was absolutely reliable, but which at the same time cost an excessive amount to maintain. Of course, in spite of its reliability its operation would have to be discontinued, as it could not compete with others which could do the work more cheaply.

"We will confine this discussion to trucks of 3,000 pounds' capacity and under. For such trucks or delivery wagons to show increased earnings over horse transportation their speed must be much greater. In delivery service such a truck must displace from two to three horse-drawn wagons.

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"In the past designers acted upon the assumption that reliability was the real key to success. With this in mind they pounced on our long-suffering and overworked friend, the pneumatic tire, and threw him out, bag and baggage. The idea was that a half hour lost now and then, due to a puncture, constituted an insurmountable barrier to the use of pneumatics. So far we will all admit that, other things being equal, the puncture-proof tire is the best to use. But it was soon found that in order to make a satisfactory showing against horses the trucks would have to run at an excessively high speed when equipped with solid tires. When it was not necessary to run these trucks at high speed the drivers generally did so anyway.

"The result was that the trucks began to come apart quite rapidly and spent considerable of their time in the repair shop. This interfered with reliability, and in addition greatly raised the sum of the items of tire cost and repairs to truck mechanism. This was not all, as it was found that these high speeds had a tendency to loosen tires so that they would come off on the road. To apply one of these tires generally necessitated the removal of the wheel and the use of a huge, clumsy mechanism, which took a man and a helper to operate. Thus when a tire came off on the road it was a case of either coming home slowly on the rim or waiting for a new wheel. These things interfered quite decidedly with reliability, besides costing money. The position of the operator of a single truck in a small town, where there was no tire-applying machine, was particularly unenviable.

"To overcome this tires were finally developed that would stay on till worn off. This last kind was worse than the first, because the operator, in order to save money on tires, would let the tire wear down until it had practically no cushioning effect. His expense for repairs would be twofold.

"In the meantime makers of pleasure cars were studying the pneumatic tire problem. It was found that there was a relation between size of tire used, weight carried, and speed at which it was carried. Given a certain weight and a certain speed, larger tires would lower the tire cost per mile, at the same time assuring greater reliability from the tire point of view by eliminating the danger of blowouts and minimizing the danger of puncture.

* * *

"In a sense the problem is analogous to retail and wholesale buying, for when tires are bought it is simply a case of buying so many miles. When larger tires are bought larger packages of miles are purchased, and the rate is cheaper. The only objection to this arrangement is that it makes the first cost look high. That is one reason why so many so-called cheap cars are unsatisfactory to their purchasers. By the use of large tires, however, we have eliminated lost tires, the wasted time installing new tires, and most of the lost time and money spent in repairing the mechanism. Therefore the reliability is actually increased about 100 per cent, while the sum of items of tire cost per mile, plus repairs to mechanism, is reduced.

"At the same time, by increasing the safe available speed the capacity of the truck per day has been increased about 50 per cent, and all this at the expense of an occasional puncture, which can be easily remedied by the cheapest sort of help in a half hour at most. We must not lose sight of the fact that cutting down the cost of repairs on mechanism also insures a far lower depreciation charge. Summing up the question of the use of pneumatics in place of solids, we find that with them:

"1. Tire cost per mile is about the same, or a little greater.

"2. Earning capacity is increased about 50 per cent.

"3. Depreciation is decreased about 50 per cent.

"4. Repairs to mechanism decreased about 50 per cent.

"5. Reliability, or total number of hours worked out of total number of chances, is increased wonderfully.

"In fact, the use of pneumatics confines the troubles of the boss of the repair shop to minor adjustments and to the repair of punctured inner tubes."

NATIONAL EXHIBITIONS.

THE first of the national automobile exhibitions, at which commercial motor vehicles will be seen, will be held in the Grand Central Palace in New York City from December 31 to January 7. The following wagon, truck, cab and bus makers have secured space: American Motor Truck Company, Atlas Motor Car Company, Brush Runabout Company, Buckeye Manufacturing Company, Chase Motor Truck Company, Ford Motor Company, Grabowsky Power Wagon Company, Gramm-Logan Motor Car Company, Hart-Kraft Motor Company, Holsman Automobile Company, Lansden Company, W. H. McIntyre Company, Mack Bros. Motor Car Company, Mitchell Motor Car Company, Rapid Motor Vehicle Company, Randolph Motor Car Company and the Sultan Motor Car Company.

The second eastern show will be held in the Madison Square Garden, from January 8 to 15.

The Chicago exhibition will be held in the Coliseum from February 5 to 12.

NEW OFFICERS OF A. L. A. M.

AT the annual meeting of the Association of Licensed Automobile Manufacturers the following officers were elected: President, Charles Clifton; vice-president, S. T. Davis, Jr.; secretary, L. H. Kittredge; treasurer, George Pope. The following executive committee was chosen: Charles Clifton, S. T. Davis, Jr., Thomas Henderson, Hugh Chalmers and Herbert Lloyd.

The Suburban Motor Transfer Company has been organized in Jersey City, N. J., with capital stock of $100,000, to operate passenger and freight vehicles.

Single cylinder 9 hp. cabs are being operated with marked success in Paris.

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The French Trials.

Particulars of the competition which lasted 26 days and tested vehicles for 3000 miles.

THE active participancy of the war authorities in the French trials, which began October 18 and ended November 15, made that event more noteworthy than would have been the case had such an element been wanting. The competition lasted for 26 days, during which period all vehicles were expected to travel about 3,000 miles.

Although nominally held under the auspices of the national automobile club, it was inevitable that the offer of a government bounty of $1,200 for each vehicle which could comply with the military requirements, should result in making the army representatives the principal factors in the undertaking. Prior to the contest it was known that each owner of a machine approved by the war department would be expected to accept a subsidy of $600 for the first year, and $200 a year for the balance of a four-year term, those so subsidized agreeing to put their machines at the disposal of the army in the event that the troops were mobilized.

* * *

Fifty-three Participants in the Competition.

Of the 53 participants 30 were tested concurrently under war office and club rules. Six machines competed exclusively for military approbation. This left only 17 to contest exclusively for the club awards.

The three principal classifications were as follows: Freight wagons, road trains and omnibuses. The freighters were divided into the following classes: Light vehicles to carry from 880 to 1,320 pounds; heavier ones to carry from 1,320 to 2,645 pounds; and heavy duty machines of three ratings. There were no entries in the road train class.

Versailles, ten miles outside of Paris, was the center of operations, the routes radiating therefrom and taking in all the close lying towns of commercial importance. A temporary garage, spanning the street, was erected in one of the wide throughfares of the quondam royal city. In stalls located along its sides the competing vehicles were stored each evening. This arrangement permitted easy exit and entrance for the machines and left a commodious central passageway in the roofed over street for regular traffic. In one end of the building spaces were set aside for offices, weighing machines, stores and the official motor cars.

Army representatives accompanied all vehicles operating under military regulations, which provided that each entry should be represented by two models of identical design, that their component parts should be made in France, and that they should be equipped with hooks, fore and aft, so as to extend or receive auxiliary aid in case of breakdown. All loads consisted of small boxes filled with stones.

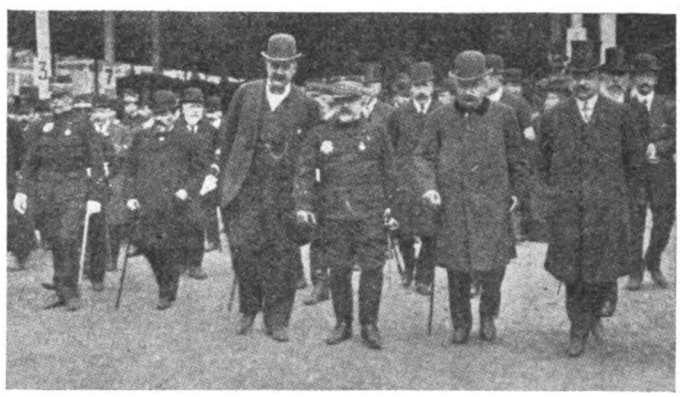
Before the trials began the weight of each vehicle, laden and unladen, was registered. All parts were officially branded, spares being sealed.

Peculiarities of Equipment.

All the competing vehicles were equipped with gas power. Electrics naturally had no place in the trials, while the two steamers which were scheduled for performance were withdrawn before the start on account of a disagreement of opinion between their makers and the military judges concerning the use of fuels. There were three examples of gas-electric design.

Excepting the machines designed to carry light loads all were fitted with solid tires. Two of the light load vehicles were equipped with twin pneumatics in the

Garage spanning the street.



Cabinet ministers proceeding to inaugurate the trials.

Soldiers loading competing vehicles with boxes filled with stone.

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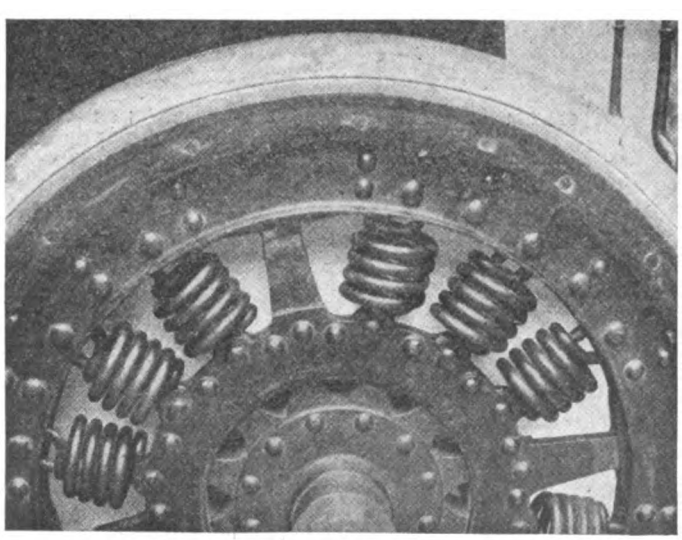
rear. The representation of wagons of low rating was very poor. This was probably due to the fact that the makers and owners of such machines were not entitled to the government subsidies. The military authorities virtually ignore the light load machine.

The front wheels of some of the light buses, carrying from 6 to 10 passengers, were shod with pneumatic tires, solids being fitted to the rear wheels. Other buses were equipped all around with pneumatics. Both two and four-cylinder engines were found in these machines, all of which were chain driven. One of the heavy buses, carrying 20 passengers, was equipped with a 12-14 hp. engine.

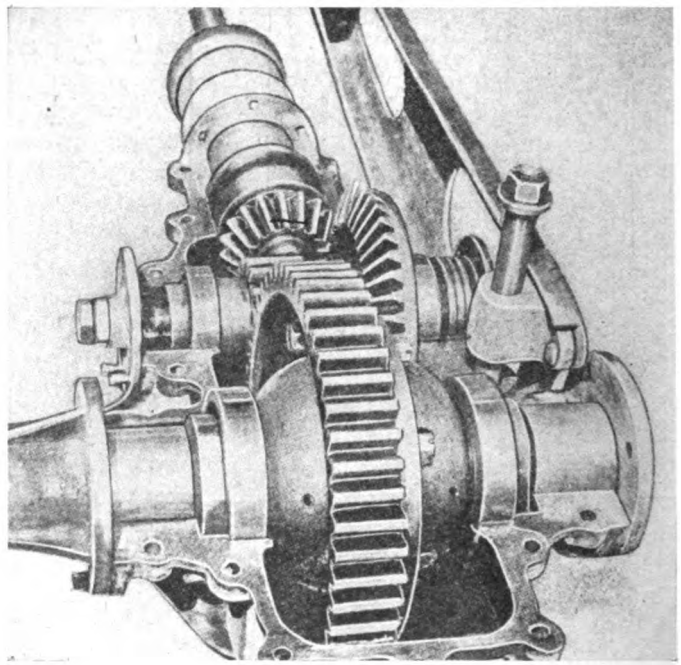
The engines of 28 vehicles were placed underneath the driver. The engines of the remainder were bonneted in the usual manner. On two of the three-ton entries the driver's control levers were placed on the left hand side, gear and brake control being located in the center. The radiator of some machines, without protection, extended as much as a foot in front of the wheels. Only one vehicle, a Berliet, was adequately protected in front against collision. Its radiator was guarded in the manner shown in the accompanying illustration.

The four-cylinder engine was found in 44 vehicles and the two-cylinder engine in 8. There was one "one-lunger." Clutches of the leather-lined cone and metal-to-metal varieties were equally represented. The ignition of all engines was furnished by magnetos.

Frames were made of armored wood, pressed steel and angle iron. There seemed to be no standard practice in spring design or method of load suspension. Steel wheels were most commonly found on the military vehicles, although the use of any type was allowed. The driving wheels of the Krieger gas-electric five-ton machine were 5 feet in diameter, fitted with pneumatic shock absorbers. With one exception, the De Dion, all the heavy duty vehicles were chain driven. The De Dion was shaft driven. In no instance were the driving chains protected. The placing of a bogey between frame and body was a common characteristic of the heavy machines. An inclination to mount the body on runners was also observed, the purpose of such design being to facilitate removal of the superstructure.



Spring wheel tested during the trials.



Vinot-Deguingand rear axle construction.

One vehicle was fitted with a spring wheel, the construction of which is well shown in the accompanying illustration.

* * *

Formula for Awards.

Awards are to be made according to a formula which considers fuel consumption per ton kilometer and the time required to make trips. This formula is as follows:

$$\frac{T}{P} - (C + C'' + KP'')$$

in which T is the duration of the runs in minutes; C the fuel consumption per kilometer in francs; C″ the consumption of lubricating oil per kilometer during the entire trials; K an estimated cost of the wear and tear of tires and wheels; P the useful load in tons, body work included; P″ the total weight of the vehicle in tons. No account is to be taken of speeds above the maximum allowed under the regulations.

The daily road tests of the competing vehicles varied from 60 to 100 miles, according to class. Throughout the competition severe grades had to be climbed.

Only one tractor figured in the competition. This was a Saurer entry. The trailer is connected by a spring drawbar with two check chains. The tractor proper is equipped with gear driven winding drum. The man on the trailer handles its brakes.

During the competition three forms of fuel were used, gasoline, alcohol and benzol. For the first 13 days gasoline was supplied to all the competitors, and on two of these days the consumption was officially controlled. The following week the vehicles consumed alcohol, with one day's consumption test. During the last portion of

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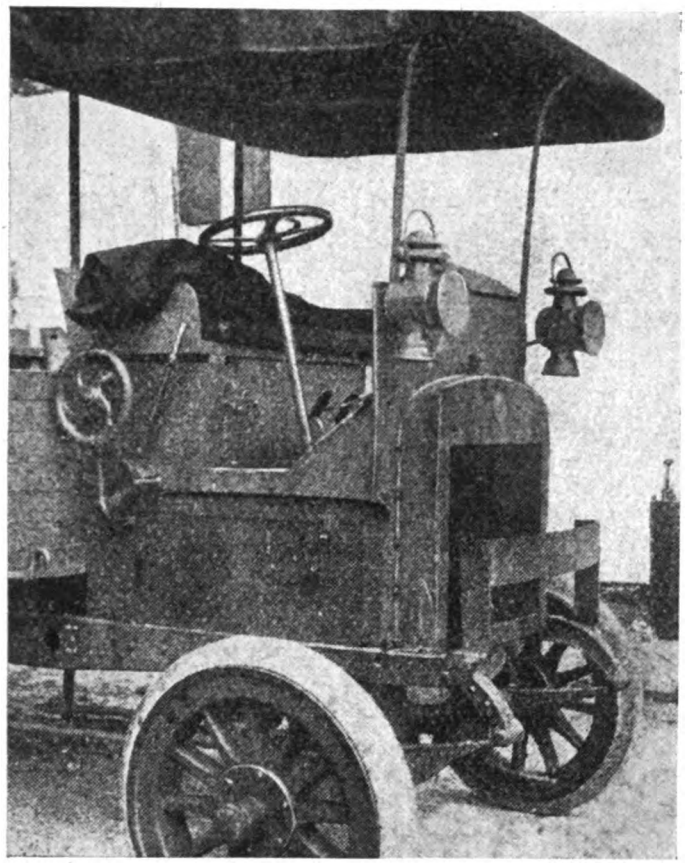


Device for protecting the radiator.

the trials benzol was used with one day for the official control of consumption.

* * *

Novel Rear Axle Design.

A novelty in rear axle construction was exhibited in the Vinot-Deguingand entry which, running on twin pneumatics in the rear and single pneumatics in front, was rated to carry a ton. The large bevel is mounted on a lay shaft lying parallel to rear axle. The gear at the end of the propeller shaft engages with the bevel on the lay shaft. A plain gear in the center of this shaft meshes with the pinion in the center of the axle.

* * *

Disqualification List Is Large.

After twenty days of road service 36 machines were left to compete for the civil and military awards. Some vehicles which were disqualified under the club rules continued to operate under the army regulations. At the period mentioned only one machine had been withdrawn from the three light load classes. In the 2-3 ton class there were eleven withdrawals, all for repairs which could easily have been remedied if the rules had permitted. Gear trouble caused the elimination of one machine in the five-ton class, while shortage of fuel and faulty brake action caused the disqualification of two more. The Saurer tractor suffered no penalty.

The best record of service for gasoline as fuel was established by the Bayard-Clement seven passenger omnibus, which covered 96 miles on 3.8 gallons, or at the rate of 25.26 miles per gallon. Another good record was established by the two cylinder Delahaye 2-3 ton truck, which traveled 71½ miles on 4.7 gallons, or at the rate of 15.2 miles per gallon. The Delahaye engine has a 4 by 7 stroke and bore. A Delahaye truck having a useful load in excess of three tons, and fitted with four cylinder engine, covered 56 miles, climbing several steep grades, on 5.2 gallons of gasoline, or at the rate of 10.77 miles per gallon.

The military convoy test was conducted over a distance of 50 miles at an average speed of 8 miles an hour, the machines in column being compelled to retain their position at a fixed distance from each other.

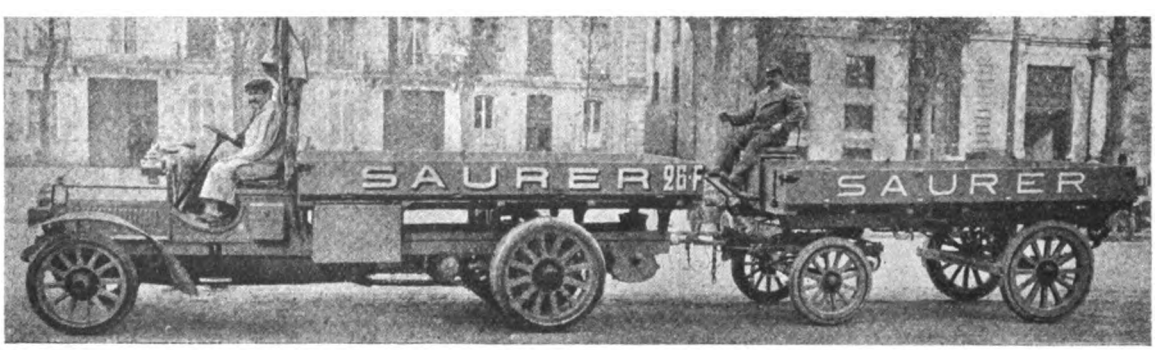
Motor cab proprietors in St. Louis, dreading the legal and commercial consequences of accidents caused by the carelessness or recklessness of their drivers, have taken steps to give both passengers and pedestrians the fullest measure of protection. They are considering the establishment of a school for drivers, the management of which is to be undertaken by the local automobile club. Legislation which will put an end to speeding, similar to that in force in Massachusetts, is also being considered.

The Kenney-Sedlay Taxicab Company has been formed to operate public service machines in Atlantic City, N. J. Its capital stock is $100,000.

Three motorcycles have been supplied to the Chicago police department as the nucleus of an official motor messenger corps.

Many of the postal motor buses in Austria are driven by soldiers.

French motor cabs are being operated in Portland, Ore.



The only multiple unit which competed in the trials.

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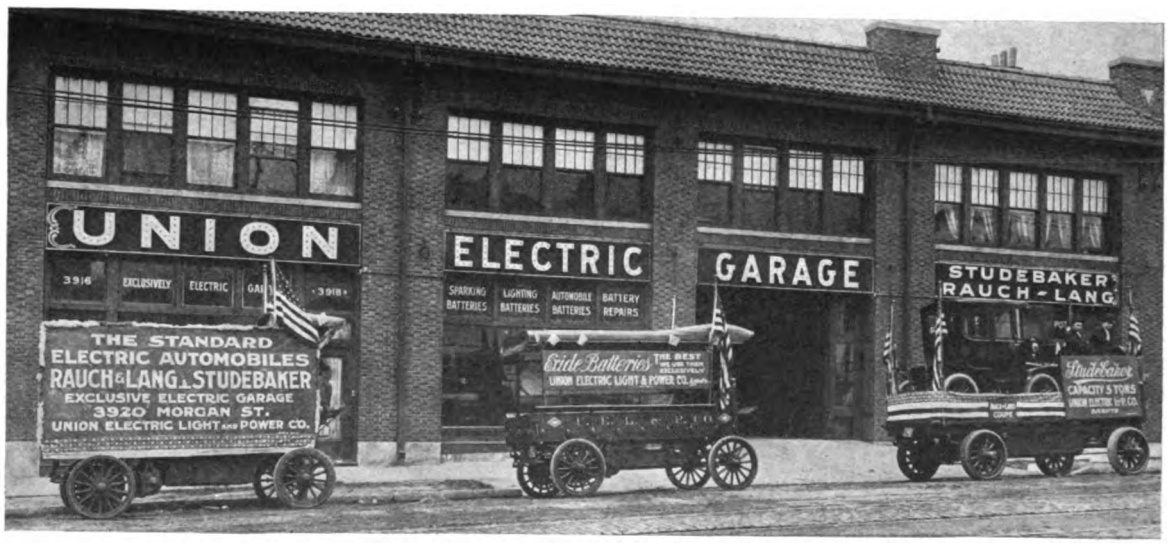

Electric garage operated by the Union Light and Power Company of St. Louis.

The Electric Garage.

Admirable system of internal administration which assures perfect road operation of vehicles.

BROADLY speaking, electric vehicles which are privately maintained are more frequently out of commission than those kept in public electric garages. Successful operation largely depends upon the quality of battery charging and the degree of attention paid to repair work. To obtain continuous satisfaction it is imperative that the right amount of current be put into the battery and that the latter be in a proper state of receptivity. With a fully charged battery of adequate capacity, and driving mechanism in good running order, the electric wagon or truck is assuredly a very economical agent when well applied.

Though outwardly alike, batteries develop individual characteristics. The expert soon learns these peculiarities, and is quick to detect the least irregularity during the course of a charge. He will keep the proper quantity of electrolyte in the cells and see that all battery jars are sound. He will see that there is no dirt on the tops of cells or corrosive acid on cable connections. Occasionally he will examine a cell to discover if the sediment is too deep. He is vigilant all the time, inspecting the motor, making sure that the brushes are properly seated and working freely, cleaning the commutator, trueing up wheels, closely examining tire fastenings, lubricating chains, and casting a critical eye over every part of the mechanism. He does not wait for trouble to develop, but anticipates it. In this manner he is enabled to keep the vehicle working at maximum mechanical efficiency, a condition that occasions the minimum of expense for maintenance.

In too many private garages there is no administrative practice worthy of the name. Batteries are often improperly charged, while repairs are only made when the vehicle has become unfit for street or road service. This lack of routine inspection is a prolific source of idle vehicle hours, operating losses, and unnecessary maintenance expense. It furnishes excuses for establishing the professional electric garage, which, from the expertness of the men on its payroll, is in position to insure both economy and reliability of service for all the machines in its care.

* * *

Model Establishment in St. Louis.

The electric garage of the Union Light and Power Company in St. Louis is a model institution. Though up to date the care of pleasure cars has been its principal business, the remarkable success achieved in that undertaking has led to the company's formulating plans for the erection of a building to be used exclusively for the maintenance and housing of electric business vehicles. This enterprise, the first of its kind in the world, will soon be launched and doubtless the best of the administrative practices employed in the present garage will be carried over to the commercial vehicle establishment. Much of the credit for this new undertaking belongs to C. E. Michel, who is in charge of the company's automobile department and is unusually well informed upon all matters affecting the economy and upkeep of electrics.

It is impossible to exercise too much care in maintaining batteries. The least irregularity affects vehicle service. Continuity of service is one of the conspicuous advantages of the well maintained electric, and such a condition is easily obtained if proper and systematic garage attention is given to the machine.

* * *

Faults of the Private Garage.

Where battery charging has been unsatisfactory in the private garage it has usually been due to faulty methods of regulating the amount of charge. The common practice of connecting the battery across the line with adjustable charging resistance in series, which is usually set at a definite point, and provided with auto-

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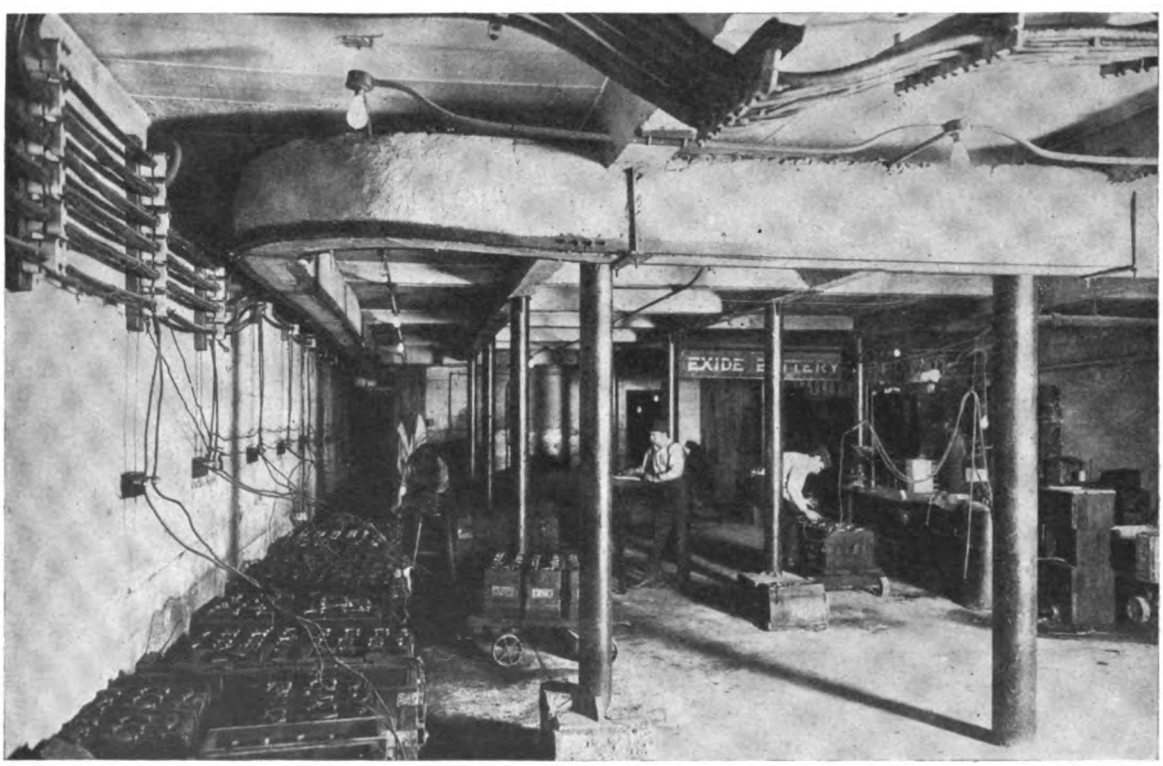
matic cutting off devices, has not been entirely satisfactory. Especially is this true where the automatics were of the low current or high voltage release type. It is well known that frequently they fail to operate, not because there is anything inherently wrong with the apparatus, but because the theory upon which they are supposed to operate is faulty. The high voltage release cut out operates when a definite and predetermined battery voltage has been reached, and the low current release operates when the currnt falls to a predetermined point. The reason for the occasional failure of the automatic devices is that neither the voltage rises to the cutting off value nor the current falls low enough so that the low current cut out operates. It is characteristic of storage batteries that as a charge continues and nears completion the voltage ceases to rise and the current ceases to fall, provided the voltage of the charging is kept constant and the adjustment of the rheostat is unchanged. If the charge is continued long after that condition has been reached, the voltage may even fall and the current rise, due to temperature rise in the cells. It is thus evident that while the apparatus may be in perfect working order, yet it may fail to operate because conditions do not become favorable for its action. The fault lies in the fact that there is not sufficient variation towards the end of charge in either voltage or current to make adequate adjustment possible. The final terminal voltage of a battery on charge is not a fixed quantity, but depends upon the age of plates, density and temperature of electrolyte, and to some degree upon the length and rate of charge, and any apparatus which operates upon a fixed final voltage or current strength will occasionally fail, provided it is so adjusted that it ordinarily cuts off the charge when a fully charged state has been reached.

The electric garage may be located anywhere. It is clean and devoid of noise or smell. Its entrance and exit should be separate. The wash room should be as near the door as possible in order to avoid soiling the floor and to speedily prepare the vehicles for such repairs as may be needed. The charging room should occupy the greatest amount of floor space. No work should be done on the vehicle in this room; the wash room, tire room, battery room and repair shop being separate. When a vehicle is to be kept in the garage it is well to give it a number. This number should be used on every tag attached to the machine, on the charging stall, charging plug, and owner's locker, in fact on everything pertaining to that particular vehicle.

* * *

Approved Methods of Charging.

There are two approved methods of charging electric vehicles. One might be termed the central or collective, the other the individual. In the central method the readings are all taken at one central station, where is located the generating plant, the switchboard recording files and rheostats controlling the current to each machine. The instruments should consist of one voltmeter and two ammeters, one ammeter showing the total current, the other showing the individual current, having the bus-bars so arranged that the readings may be taken from any machine on charge. The only readings that cannot be taken here are acid gravities and voltage of the separate cells. In the individual method the rheostats are placed back of each separate machine and readings usually taken from the machine meter, though the current may be read from the main switchboard. Both systems have their merits. In both a careful tag system



Battery Room of the electric garage operated by the Union Light and Power Company.

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is universally used. On these tags is printed the records for each vehicle. These records must be in detail. Not only are charging records made, but also records of repairs and performance. These records can be tabulated to prove the success of the electric vehicle and to prevent misunderstandings of accounts, and so perform one of the most important details of the garage work.

The source of power varies. There is nearly always a local power plant anxious to serve the electric garage, especially if an agreement can be made whereby the garage uses most of its current away from the peak of the company's load. This is naturally the time when the garage needs most of its current. The price, for this reason, ought to be less to the garage than to any other consumer. If direct current is supplied, a switchboard with regular rheostats is all that is needed. If the current is alternating, some method of transforming to direct is necessary. For the large loads or periods of large loads a motor generator set is best. For smaller loads the mercury arc rectifier is preferable. In isolated places the garage may generate its own current, there being on the market at the present time many reliable gasoline generating plants.

There should be rolling tables to take the batteries to the battery room. It is not a good policy to subject the paint, iron and upholstering of a vehicle to the acid fumes. The battery room, as well as the charging room, must be in charge of trained and competent men. These men, in fact, must be experts, as they are the mainstay of the electric garage. The personnel of an electric garage housing 25 machines will be one expert, two washers, a machinist and a manager. This, with a bookkeeper, ought to complete the payroll. The other expenses in the garage will be rent, insurance and power. The rent averages about $2 per month per machine and the current costs from $5 to $7 per month per machine.

* * *

Routine Administrative Practice.

Routine administrative practice in the Union Light and Power Company's electric garage is as follows: When a car comes into the garage it is placed on charge at, say, 9:30 p. m. at the normal charging rate. Every thirty minutes thereafter a battery man takes an ampere and volt reading on this battery. This is done by the operator at the switch board simply throwing a switch which cuts a volt ammeter in series with the battery. The battery is started off at the normal charging rate, which is dropped to the finishing rate when the voltage has reached the proper point. At the end of the charge a specific gravity reading over at least six cells is taken and entered on the sheet marked "Record A." On the same sheet is shown the maximum temperature the battery reached. (Only one-half of "Record A" is shown in the cut.)

"Record B" contains specific gravity and voltage

RECORD OF SPECIFIC GRAVITY.						Hours Discharge,				
	190			190			Discharge Rate,			Amps.
	Amps.			Amps.						
Cell Number	Volts	Specific Gravity	Cell Number	Volts	Specific Gravity	Cell Number	Time / Volts	Time / Volts	Time / Volts	Time / Volts
1			1			1				
2			2			2				
3			3			3				
4			4			4				
5			5			5				
6			6			6				
7			7			7				
8			8			8				
9			9			9				

Record "B."

TIRE RECORD.

Wheel	Kind of Tire	Date Put On	Odometer Reading	Date Taken Off	Odometer Reading	Net Miles Per Tire

Record "C."

readings of each cell (only nine shown in cut). "From these readings," says Mr. Michel, "taken when the battery is supposed to have reached its full charge, and is still on charge at the finishing rate, each day I get an idea of about how long it takes the battery to charge, and how many miles the battery ran during the day. I can judge how quickly the temperature of the battery increases, and at least twice a month I get a complete specific gravity and volt reading on the entire battery. By careful analysis of these records from day to day, with a knowledge of the age of the battery and how long since it was washed, a man familiar with storage batteries can come very near telling the condition of the battery.

"In addition to this I ask for individual records of specific gravity and voltage of different batteries on which there is some question in my mind. I usually work this so that I get at least three readings per month on each cell in each battery in the garage.

"As every battery in the garage is watered every night, if necessary, it is almost impossible for a 'leaker' to get by. I find that with the aid of competent battery men, who leave me notes each morning on anything out of the ordinary they notice in any battery, and by carefully studying the records I have, I can keep my batteries in A-1 condition.

"To show how well my customers agree with me: When I find that a battery is sulphated from any one of a number of different causes (and this can generally be told from the records I keep) I telephone the owner and tell him that he cannot have his car the next day, for we are holding it in for a slow overcharge. New customers usually kick, and we sometimes have to insist very forcibly that they do not take the car out. However, in the case of old customers there is never a question, as they

BATTERY CHARGING RECORD.

NAME.	PLUG.	7.00		7.30		8.00		8.30		9.00		9.30		10.00		10.30		11.00		11.30		12.00		12.30		Gravity Pilot Cell.	Size and No. of Cells.	Maximum Temperature.
		A.	V.	A.	V.	A.	V.	A.	V.	A.	V.	A.	V.	A.	V.	A.	V.	A.	V.	A.	V.	A.	V.	A.	V.			

Record "A" used in St. Louis electric garage.

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realize we are looking out for their interests. They know that this additional service costs them nothing, and the mere fact that we voluntarily go to the additional expense and trouble that a slow overcharge entails makes them more confident than ever that we are looking out for their interests as well as our own."

* * *

Plant of the Union Company.

The Union Light and Power Company's garage is a two-story brick building standing on ground 100x100 feet. The doors and windows are fitted around the edges with rubber sheeting, and the floor, which is of concrete, is treated with a special chemical paint which fills up the pores of the concrete and prevents dust from arising.

The charging facilities are unusual. A sub-station of the Union company is located at the rear of the garage. In this station is a large direct current machine, which is operated almost entirely for the use of the garage. The switchboard is placed on the garage side of the wall that separates the two establishments, and consists of a marble faced board equipped with sixty-two double throw switches and sixty-two rheostats. Each of these lines runs to separate plugs located along the walls and special posts throughout the garage, making it possible to charge sixty-two cars at once, each machine being on its own individual circuit. The arrangement on the board itself is such that the operator is in touch with every battery on charge in the garage. The board is divided into two parts, each side equipped with its own volt-ammeter. In order to take a reading of a battery on charge the operator merely walks to the board and throws a knife switch, bringing the meter on the board in series with the battery.

After visiting a number of cities in which motor fire vehicles are employed, an investigating committee representing the authorities of Wilmington, Del., has decided to recommend the purchase of a machine which will cost $8,500.

Six motor buses are operating between Foster, Riverton and Seattle, Wash. Each machine seats 34 passengers. The service is being operated in competition with the local electric railroad. The round trip is made in an hour and a half.

In two months the motor driven fire engine employed in Alliance, O., has covered 200 miles, counting exhibition runs. The bare operating cost amounted to $15.92. If horses were used in the service to which this machine is assigned the operating cost would be $70.76 and the employment of four additional men would be required.

The head of the fire department in Dubuque, Ia., is urging the purchase of a motor vehicle for heavy service.

The recent destruction of a school building by fire is causing residents of Fish Kill, N. Y., both women and men, to clamor for the installation of a motor hose and chemical wagon.

EUROPEAN ELECTRICS.

UPON his return from Europe Emil Gruenfeldt, chief engineer and designer of the Baker Motor Vehicle Company, declared that the foreign electrics use too thin a plate in the battery. While such plates give high mileage in the beginning, they are short lived, and hence are not commercially or mechanically satisfactory. The series wound motor is becoming standard. Continuing his criticism, Mr. Gruenfeldt says:

"The 'drum' type controller is employed in all European electrics. The electric brake and recharging points formerly used have been discarded. The whole tendency abroad is to simplify the vehicle, yet in this respect American designers have far surpassed the best efforts of foreign manufacturers.

"European electro-chemists experimented with alkali batteries for many years, but could not overcome the disadvantages of the great potential drop under overloads and their limited recuperative power, a fault which the late American batteries of this type still show. The pasted lead battery is the standard abroad.

"Solid and cushion tires have both been used abroad, especially for taxicabs, but, on account of the heavy vibration of the car and the loosening and breaking of vital mechanical parts, they have been practically discarded, and the late cars are equipped with pneumatic tires. Even electric trucks and buses are being equipped with pneumatic tires of the twin and triple type, that is, two or three individual tires side by side on the same wheel.

"No other type of motor car has a greater opportunity for obtaining export business than the electric, and if American manufacturers will establish foreign agencies and push sales they are certain to obtain large orders abroad. American electrics are so much superior in design and efficiency to foreign cars that comparisons are odious."

The purchase of a motor hose and chemical wagon, to cost $5,500, has been recommended by the mayor of Newton, Mass.

A 45 hp. motor ambulance, costing $5,000, has been turned over to the authorities of the city hospital in Cincinnati.

Motors have superseded horses on the 35-mile stage route between Bethel and Erroll, Me.

The Kansas City Rapid Motor and Transportation Company has been organized with capital stock of $50,000.

Efforts are being made in Little Rock, Ark., to have the city council authorize the expenditure of $7,500 for the installation of a piece of motor fire apparatus.

Suit for $3,000 damages has been commenced by a Boston priest who was injured while riding in a motor cab in Waterbury, Conn. The machine collided with a tree.

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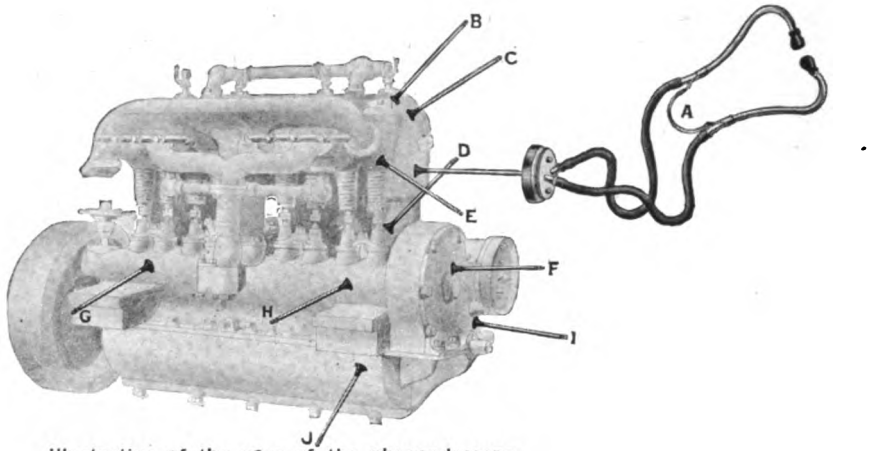

Illustrative of the uses of the phonendoscope.

Scientific Location of Foreign Engine Sounds.

Description and application of an instrument which resembles the stethoscope used in medical diagnosis.

EVERYONE is familiar with the important service which the stethoscope is capable of rendering to the physician who is called upon to make an examination of the human heart and lungs. The principle of its use is now applied in an instrument which aids in detecting foreign noises in the engines of commercial motor vehicles and, by accurately locating them, enables the garage foreman to order repairs and adjustments made before serious deterioration and loss of power occurs. This instrument, a foreign invention, is termed the phonendoscope. It is sold in this country by G. P. Pilling & Son of Philadelphia.

* * *

The difficulty of locating internal engine irregularities by listening with the naked ear is chiefly due to the constant presence of normal noises issuing from the motor while in motion. Many times an engine is supposed to be suffering from cylinder knocking, loose pistons or loose connecting shaft, when in reality the sounds upon which such diagnoses are made indicate that the trouble is seated in some other part of the power plant. Even expert workmen, mistaking the origin of the trouble, may labor for hours without ascertaining the true cause of the foreign noises, disassemble many parts, reassemble them again and pronounce the engine fit for duty, while if it is put on the test block it will again develop the symptoms which originally caused it to be overhauled. Misdirected effort of this sort is both costly and aggravating, especially in an establishment which uses many motor vehicles. It is, or should be, the test of fitness for a commercial motor vehicle garage foreman or repairman that he can speedily provide an adequate remedy for all deranged mechanism. Idle machines represent heavy loss if loads are waiting to be moved.

The engine of a wagon, truck, bus or cab is the source of considerable trouble in establishments which employ large numbers of such vehicles and operate them with great activity. Interruption of their service either causes a sharp decline in the tonnage hauled or a loss of earnings, or both. If the idle and unprofitable periods can be reduced to the minimum the vehicles will obviously be working at maximum service efficiency. The physical condition of the equipment is at its best when the methods adopted for its maintenance are scientifically applied. To guess at the origin of hidden mechanical troubles, when accurate diagnosis is possible, is not scientific practice.

* * *

The method of applying the phonendoscope is as follows: Place the flexible cables to the ears and hold the diaphragm head in one hand, putting the hard rubber button end in contact with that part of the motor from which it is suspected the foreign noises proceed. The accompanying drawing partly indicates the manner of application and, in addition, suggests the parts in a four-cycle motor where foreign noises are most likely to develop.

A—Locates ring and connecting rod knocks.

B—Locates loose pistons and premature explosions.

C—Locates the same in this type motor.

D—Locates noisy push-rods and is a sure finder of a bad cam.

E—Locates the noisy valve, either loose in guide or seating.

F—Locates tightly meshed eccentric, or gears cut small, all of which are very noisy.

G—Locates noisy cam shaft bearings (place right over bearing).

H—Locates the same, but in another location.

I—Locates the same, but is another location. (Best to try many places.)

J—Locates loose connecting rods on crank-shaft, and lateral of the crank-shaft in its bearings.

The city council of Moline, Ill., is considering the purchase of a motor patrol wagon for the police department as well as a motor chemical wagon for the fire service.

The Beaufort Auto Transfer Company has been formed in Beaufort, S. C., with capital stock of $5,000.

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Comparison of Motor Fuels.

The government conducts 2000 tests with alcohol and gasoline and publishes results of investigation.

RESULTS of 2,000 tests of gasoline and alcohol as motor fuels are contained in a document recently issued by the government and prepared by Robert M. Strong of the Geological Survey. Work began with the use of the two fuels in the same motor. Comparative tests were subsequently conducted with other engines of approximately the same size and speed, but having different degrees of compression, different carbureters and different methods for governing. The following conclusions were reached at the end of the investigation:

Almost any gasoline motor with a well-designed carbureter will run as well with alcohol as with gasoline, from the standpoint of operation, except for a difference in ease of starting and in certainty of operation at low speeds. Under conditions requiring widely varying speeds the motor is less certain to operate satisfactorily at very low speed when alcohol is used, unless some special adjustment is made. The only change required for the use of alcohol in a gasoline motor, if any, is in the size of the fuel passageways. The fuel needle valve must be capable of being opened twice as wide for alcohol as is required for gasoline, and the spray nozzle must not be restricted to just the size that is required to supply the needed quantity of gasoline. The fuel passageways in a carbureter can usually be easily drilled out, and so far as producing power at constant speed is concerned the motor will be just as serviceable with either fuel. This change need not be such as to affect the consumption of gasoline, but with this change alone the consumption of alcohol will be found one and a half times to twice as much as the consumption of gasoline for the same power.

* * *

Alcohol in an Alcohol Motor.

By using alcohol in an alcohol motor with a high degree of compression—about 180 pounds per square inch above atmospheric pressure, much higher than can be used for gasoline on account of preignition from the high temperatures produced by compression—the fuel-consumption rate in gallons per horsepower per hour can be reduced to practically the same as the rate of consumption of gasoline for a gasoline engine of the same size and speed. The indications are that this possible one to one fuel-consumption ratio by volume for gasoline and alcohol motors will hold true for any size or speed, if the cylinder dimensions and revolutions per minute of the two motors are the same.

An alcohol motor is as adaptable to commercial requirements as a gasoline motor, except that with the present types of carbureters the same increased difficulty in starting and in operating at very low speeds is experienced as for a gasoline motor when alcohol fuel is used. The adaptability of alcohol is such, however, that the difference, which is due to ineffective vaporization, is not necessarily permanent.

Alcohol in a Gasoline Motor.

When alcohol is used in a gasoline motor with the maximum degree of compression for gasoline, the available horsepower of the motor is increased about 10 per cent. An alcohol motor with the maximum degree of compression for alcohol will have an available horsepower 30 per cent greater than a gasoline motor of the same cylinder size, stroke and speed. Owing to the higher explosion pressures, however, an alcohol motor should be built heavier than a gasoline motor, but the weight per horsepower may be less.

Some gasoline motors may be so changed that a sufficiently high compression pressure is secured to make it possible to reduce the consumption of alcohol in gallons per horsepower per hour to an equality with that for gasoline before the motor was changed; the change, however, precludes the further use of gasoline, as it cannot be used satisfactorily with compression pressures much in excess of 70 to 75 pounds per square inch above atmospheric. The degree of compression may be most easily changed by lengthening the connecting rod, which changes the position of the piston at the extreme end of the compression stroke. This can only be done, however, in a motor which is not counterbored and in which the shape of the clearance space is such that the piston will not strike the cylinder head or valves. The type of connecting rod usually used for stationary motors can be lengthened very easily by putting liners between the crankpin end of the connecting rod and the crank brasses. This makes it possible to adjust the degree of compression to whatever fuel it is desired to use with but little trouble.

If the cylinder is counterbored, or if there is not sufficient room at the head of the cylinder to allow the piston to travel back far enough to increase the compression pressure to the amount desired, a new cylinder head should be cast with smaller clearance space. Attaching plates to the piston or cylinder head is seldom, if ever, satisfactory. The arrangement of the valve-actuating mechanism often determines the position of the valves, which may be such that a small enough clearance space cannot be secured without almost an entire redesign of the motor. Furthermore, with the increased compression pressure required for the economical use of alcohol, the maximum pressure from explosions or combustion will increase and will be as high as 600 or 700 pounds per square inch for maximum load when the compression is raised to 180 or 200 pounds per square inch above atmospheric pressure.

* * *

Starting With Alcohol Is Difficult.

The increased difficulty of starting a motor with alcohol and the increased uncertainty of operation under variable speed conditions has suggested the use of gasoline and alcohol in a double carbureter, which mixes the vapors or sprays of the two fuels with air in the usual

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manner. Tests on two similar motors having different degrees of compression were made with such mixtures. For the two engines twenty-six and twenty-one tests were required to obtain the best time of ignition and best mixture quality—as regulate by the fuel needle valve and auxiliary air valve—for seven different proportions of gasoline and alcohol. The results obtained are not as conclusive for the tests with the higher degree of compression as might be wished on account of affecting motor conditions which were known and recorded but not eliminated. The results of these tests indicate, if rightly interpreted, that the maximum thermal efficiency for mixtures of gasoline and alcohol will vary from that for alcohol alone to that for gasoline alone, when the best degree of compression is used in each case; and that the total fuel consumption will not be less than the minimum for either fuel alone and will depend on the limiting degree of compression for each different proportion. If this be true, there is no advantage in using gasoline and alcohol together except for starting and operating under conditions of variable speed; and these advantages should be obtainable through some other means, such as more suitable design of induction passageways and carbureter. Moreover, the use of gasoline in any appreciable quantity does away with many of the advantages that are obtained from the use of alcohol alone, such as safety and absence of disagreeable odors.

* * *

Increasing the Compression.

The fact that the limiting compression pressure for gasoline and alcohol used together always was greater than for gasoline alone suggested that possibly by substituting water for alcohol and so increasing the limit of compression a corresponding increase in thermal efficiency for gasoline could be obtained. Following this suggestion, tests were first made on a gasoline motor with various proportions of gasoline and water. So far as possible, the best results were obtained for each given proportion from all gasoline to as much water as gasoline, but no change in the thermal efficiency or rate of consumption of gasoline could be made; this result showing that the effect of the water, if any, was balanced. Since higher compressions could be used, depending on the proportion of water, a similar set of experiments was made with one of the alcohol motors, in which the compression pressure was about 130 pounds per square inch. Again, the thermal efficiency could not be increased or the consumption rate decreased to values better than the best obtained for gasoline alone in a gasoline motor.

In general, the introduction of a small quantity of water with the fuel will prevent preignition from too high compression or overheated parts in the clearance space. The heavy explosion pound often obtained in a gasoline motor operating under maximum load may be entirely eliminated and the running of the motor made much quieter and smoother by using a small quantity of water. The shock and wear of moving parts is thus obviously reduced. If the water contains any grit, however, the cylinder and piston will soon become scored; hence, ordinarily it is not advisable to use a spray of water continuously with the air or fuel. The amount of cooling water required to keep the cylinder walls at a given temperature is diminished very noticeably when as much water as gasoline is taken into the cylinder, and the effect of smaller quantities of water is proportioned.

* * *

Results of Proper Alcohol Motor Compression.

When the degree of compression is in each case that best suited to the economical use of the fuel designated, some types of gasoline motors are better adapted to the service for which they are designed than similar alcohol motors, and vice versa. The relative amount of fuel consumed being disregarded, this is also true when the degree of compression is that ordinarily used for gasoline mixtures, as when denatured alcohol is used in gasoline motors; but in general the alcohol motor is or can be so designed and constructed as to be equal to the gasoline motor in adaptability to service.

A gasoline motor having a compression pressure of 70 pounds, but otherwise as well suited to the economical use of denatured alcohol as gasoline, will, when using alcohol, have an available horsepower about 10 per cent greater than when using gasoline. When the fuels for which they are designed are used to an equal advantage, the maximum available horsepower of an alcohol motor having a compression pressure of 180 pounds is about 30 per cent greater than that of a gasoline motor having a compression pressure of 70 pounds, but of the same size in respect to cylinder diameter, stroke and speed.

When denatured alcohol is used in 10 to 15-horsepower four-cycle stationary motors having a compression pressure of approximately 180 pounds and the motors are operated at their maximum loads, the pressures during explosion or combustion reach 600 to 700 pounds. Stationary gasoline motors, in which the compression pressure in some cases can be raised to 180 pounds, are not usually built heavy enough to withstand such explosion pressures for any length of time.

* * *

Fuel Consumption.

When any of the usual methods of governing are used to control the speed of gasoline or alcohol engines, the rate of fuel consumption per brake horsepower per hour will ordinarily be about twice as great at one-third load as at maximum load. At the same time an excessive rate of consumption of gasoline or denatured alcohol at any given load, if due to the incorrect adjustment of the mixture quality and time of ignition only, may be as great as, but not greater, than approximately twice the minimum required before it will be noticeable from outward indications.

* * *

Cleanliness and Safety of Alcohol.

In regard to general cleanliness, such as absence of smoke and disagreeable odors, alcohol has many advantages over gasoline or kerosene as a fuel. The exhaust from an alcohol motor is never clouded with a black or grayish smoke, as is the exhaust of a gasoline or kero-

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sene motor when the combustion of the fuel is incomplete, and it is seldom, if ever, clouded with a bluish smoke when a cylinder oil of too low a fire test is used or an excessive amount supplied, as is so often the case with a gasoline motor. The odors of denatured alcohol and the exhaust gases from an alcohol motor are also not likely to be as obnoxious as the odor of gasoline and its products of combustion.

Where the restrictions placed on the use of denatured alcohol are less than those placed on the use of gasoline, or where safety and cleanliness are important requisites, the advantages to be gained by the use of alcohol motors in place of gasoline motors may be such as to overbalance a considerable increase in the fuel expense, especially if the cost of fuel is but a small portion of the total expense involved, as is often the case. Denatured alcohol will, however, probably not be used for power purposes to any great extent until its price and the price of gasoline become equal and the equality of gasoline and alcohol motors in respect to adaptability to service required and quantity of fuel consumed per brake horsepower, which has been demonstrated to be possible, becomes more generally realized.

* * *

Few Alcohol Motors in Service.

Very few alcohol motors are being used in the United States at the present time, and but little has been done toward making them as adaptable as gasoline motors to the requirements of the various classes of service. Motors for stationary, marine, and traction service, motor cars, motor trucks, and motor railway cars designed especially to use denatured alcohol have, however, been tried with considerable success.

Considerable attention is being given to the development of processes for the manufacture of alcohol from cheap raw materials which are generally available, and it seems reasonable to expect that the price of denatured alcohol will eventually become as low or lower than the price of gasoline, especially if the price of gasoline advances. It also seems reasonable to expect a greater general improvement in alcohol motors than in gasoline motors.

AUTOMOBILE RAIL TRANSPORTATION.

STONE CANON, an isolated mining town in California, is now connected with Chansler, 22 miles away, by a rail automobile carrying seven passengers. The vehicle is equipped with a six-cylinder engine and six steel wheels. Spur tracks will soon be laid and freight service supplied. Long stretches of deep sand mark the roadway between the two points, making motor bus or wagon service impracticable. The rail car running over private right of way, is a modification of a Premier.

Rich residents of Hackensack Heights, overlooking Hackensack, N. J., have organized a volunteer fire department which will be supplied with a motor hose and chemical wagon.

WASHINGTON POLICE WAGON.

THE Washington police department has just installed a Franklin machine equipped with pneumatic tires and an 18 hp. air-cooled engine. The vehicle can be used either for patrol or ambulance work. The inside seats are hinged so as to lift and provide space for stretchers and other ambulance paraphernalia. The space under the seats is accessible by small doors in the rear of the body. There is a medicine chest under the driver's seat and another compartment for supplies back of the seat. The pneumatic tires, 37 by 5 inches, are especially large for this comparatively light vehicle. In front the vehicle has full-elliptic springs and at the rear semi-elliptic and coil springs. Its weight, fully equipped with gasoline and oil, is 2,980 pounds.

Washington (D. C.) police wagon.

FRICTION DRIVE ON STEEP HILL.

THE Johnson Transfer and Fuel Company, of Bloomington, Ill., recently purchased a two-ton Sternberg friction driven truck which was sent overland from factory to destination. The buyers state that the work of the machine in climbing the big hill in Bloomington is exciting general surprise among the owners of horse-drawn trucks. The machine is often stopped in the ascent in order to demonstrate the positiveness of the engagement of its friction drive. No team in the city can pull a load up the hill if a stop is made at any part of the incline.

One of the Chicago motor cab companies has offered to contribute $100 to a fund to be used for the erection and maintenance of permanent steel gates at the approaches to swinging river bridges in case the city authorities refuse to install these much needed protective structures.

At present there are 158 subsidized industrial motor vehicles in Germany, all subject to military draft in an emergency.

Money is being raised by popular subscription in Atlantic City, N. J., for the purchase of a motor ambulance for one of the local hospitals.

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Subsidies for Motor Trucks.

Specifications for machines which may be used by the German war authorities in time of National peril.

SUBSIDIES are granted by the German government to owners of motor trucks, provided the vehicles are constructed according to the specifications of the war department, and the owners enter into a contract with the authorities to place the machines at the government's disposal whenever the army is mobilized, and to keep them always in such a condition during a period of five years that they can be utilized for military purposes. The machines are tested by military experts to ascertain if they fulfill the requirements of the specifications, and are subject to inspection by army officials at any time. Sales of subsidized trucks during the 5-year period can only be made in Germany, and then only on the condition that the buyer binds himself to carry out the terms of the unexpired contract. Sales of subsidized trucks to residents of foreign countries are not permitted.

The subsidies granted are 4,000 marks ($952) for each motor van and trailer and an annual payment of 1,000 marks ($238) for 5 years. The specifications for subsidized trucks are as follows:

1. The trucks, which must be constructed in Germany, shall consist of one freight motor and one trailer.

2. The freight motor must be capable, with all its equipment, to carry a load of at least 4,000 kilos (8,818.5 pounds) and the trailer a load of at least 2,000 kilos (4,409.25 pounds), or a total weight of at least 6,000 kilos (13,227.75 pounds), on well-built streets or roads. The weight of the motor truck alone, with filled fuel and oil tanks, tools, sand box, etc., must not exceed 4,500 kilos (9,920.8 pounds), and with its personnel 9,000 kilos (19,841.6 pounds).

3. The highest speed, with iron tires on level roads, shall not exceed 12 kilometers (7.5 miles) per hour, and with rubber tires 16 kilometers (9.9 miles) per hour. The average speed should be, with iron tires, 9 kilometers (5.6 miles) per hour—day's work about 90 kilometers (55.9 miles); with rubber tires, 13 kilometers (7.5 miles) per hour—day's work about 120 kilometers (74.6 miles). When iron tires are used, the driving apparatus (chain, sprocket, etc.) shall be so constructed, and the diameter of the wheels such, that the speed of 12 kilometers (7.5 miles) per hour cannot be exceeded.

4. The motor trucks with trailer, when fully loaded, must be able to take, under normal conditions, all inclines from 1 to 7 per cent.

5. The quantity of fuel and oil, etc., must be sufficient, even under unfavorable circumstances, for a distance of 250 kilometers (155.3 miles); for steam motors, 80 kilometers (49.7 miles).

6. The body of the motor truck must have an interior space of 4 cubic meters. The maximum width over all must not exceed 2 meters (6.6 feet), with an approximate length of 4 meters (13.1 feet).

7. The tread of the wheel depends on the width of the truck, but must not exceed 2 meters (6.6 feet). The distance of the wheel centers shall not exceed 4.50 meters (14.8 feet).

8. The personnel shall be protected from the weather.

9. The lighting shall consist of: (*a*) A large acetylene searchlight, with separate gas generator. Strong, blinding lights are forbidden. (*b*) Two petroleum lamps.

10. Motor with minimum 35 horsepower with a maximum of 850 revolutions per minute. The differential must be capable, when motor-free and also at first and second speed, to increase the number of revolutions by about 100. First speed, 2.2 miles; second, 4 miles; third, 7.5 miles; fourth, 9.9 miles.

11. The motor, with a removable cover, is to be placed in front of the chauffeur's seat. The driving gear as well as the truck must be provided with all the modern improvements, so that absolute safety in working is insured, even in winter. It is of the greatest importance to provide adequate cooling, even for long trips at a slow speed, and every part of the motor must be easily accessible. Cars with chain drive must use the chain prescribed by the testing department.

12. It is imperative that the machine shall be capable of permanently using fuel produced in Germany.

13. The brake apparatus must be such as to insure safety in running with trailer down hills. The cars must be equipped with specially strong block brakes for hilly country and secured against bumping by stop blocks worked by chains.

14. The coupling device for the trailer is to be attached to the frame of the motor truck and is to be protected from uncoupling by a spring when going ahead or backing. In the front of the chassis two hooks are to be attached, by which the whole loaded train can be hauled. Steps must be placed at the back and at the side of the vehicle.

15. The wheels must comply with the specifications provided by law, and are to be constructed in such a manner that devices for running over icy, snow-covered, and slippery roads can be easily and securely attached. For this purpose only wheels with solid rubber tires protected by rope are to be used. Therefore the wagon must be equipped under all circumstances with a set of wheels with solid rubber tires.

16. Every motor truck is to be equipped with the following tools: Accessories and reserve parts, except those of a special construction requiring special tools. The parts are to be stowed in water-tight, easily accessible closed cases, so that everything has its special place and is tightly packed.

17. One lever, 1 pickax, 1 spade, 1 hatchet, 1 wagon jack with a raising power of at least 10 tons, sufficient tools and repair parts for getting ready and keeping the trucks in good order.

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18. Two sucking valves, 2 exhausting valves, 2 sucking-valve springs, 2 exhausting-valve springs, 1 complete set of bearings for piston rods, 1 complete set of bearings for crank shafts, 8 piston rings, 1 set packings, 6 stuffing boxes of different sizes, 4 complete lighting mechanisms, 5 meters match cord, 1 spring core for front springs, 1 driving chain, 4 chain links, 4 chain-link bolts, 10 meters ventilator strap, 2 brake blocks, 2 spare springs, 2 leather cones for coupling, 1 meter water hose.

19. The trailer must be capable of carrying a minimum load of 2,000 kilos, and so strongly built that the attachment of a second loaded trailer may be possible, at a maximum speed of 16 kilometers per hour. The trailer must be supplied with safety brakes (block or band brake) properly protected against mud and also equipped with stop blocks for hilly country. The trailer must be adapted for animal propulsion and must carry the necessary devices therefor.

20. The coupling loops for coupling the truck and trailer must be placed about 85 cm. above the surface of the ground and in such a manner that they can be protected against dirt. The brakeman's seat must be placed sideways, so that the brakeman can overlook the whole train from his seat. There must be a reliable working signal connection between the brakeman and the chauffeur.

In time of war any automobile may be seized by the military authorities, the indemnity to be paid to the owner being fixed by a board of military appraisers.

The police department of Washington, D. C., now uses a motor patrol wagon which cost $3,000. If its service proves satisfactory congress will be asked to appropriate money for buying machines for all of the police precincts.

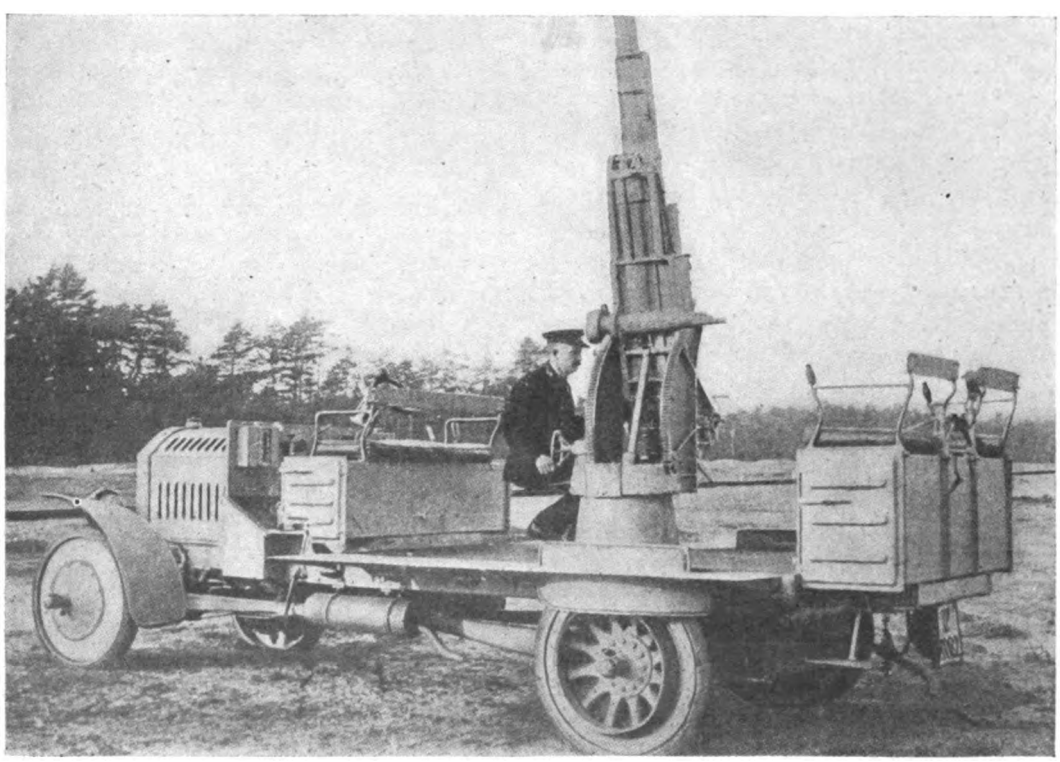
NEW MILITARY MODEL.

THE growing use of military airships and balloons has given occasion for the production of a fast moving vehicle equipped with a machine gun which is capable of destroying them. Ever since the German war authorities succeeded in establishing the value of the dirigible military balloon, which has a lifting capacity far in excess of the monoplane, biplane or other form of aerial craft, and consequently is regarded as more destructive potentially, ingenious men of war have been at work designing machine guns for counter attack, both stationary and portable in form.

A weapon of the latter character is shown in the illustration presented below. It is mounted on an armored motor vehicle, all four wheels of which are driven so as to overcome the traction difficulties which steep grades and uneven ground present. This vehicle can attain a speed of 72 miles an hour on level roads. When a shot is about to be fired struts are placed under the platform so as to relieve the wheels and axles of shock. Seats for five men are provided. The ammunition box contains 82 shells. It is confidently believed that this vehicle and weapon afford an effective means for destroying military air craft. The gun has an unlimited field of action both sideways and in a vertical plane.

The expenditure of $5,000 for a motor hose and chemical wagon is being considered by the authorities of Somerville, Mass.

The authorities of Allentown, Pa., have been requested to allow the expenditure of $3,500 for a motor hose wagon. The purchase will probably be made next year.



Gun mounted on motor truck for destroying air craft.

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Motor Bus Regulations.

Elaborate rules which govern the construction and equipment of London public service vehicles.

EVERY precaution which operating experience and an alert police could suggest is incorporated in the regulations which govern the traffic of motor buses in London. The design of the machines, their equipment, seating capacity, body dimensions, speed, and behavior during passage from barn to destination, are all matters of the deepest concern to the municipal authorities. This watchfulness is in striking contrast with American practice for the official control of public service motor vehicles. The thoroughness with which the work of the London machines is policed may be best understood by studying the regulations. They are as follows:

1. Each new type of motor vehicle intended for licensing must be presented at Scotland Yard for inspection. The proprietor must at the time of inspection produce the certificate of registration, also one from the maker stating that the materials of which all the parts of the vehicle are constructed are good, that the machinery is safe, and that the vehicle is in every way fit for use as a public carriage.

2. If, after inspection, the vehicle is approved, such approval may extend to all vehicles of that description, and others of the same type need not be again presented at Scotland Yard, except as hereinafter provided, but taken to the passing station of the district, provided a certificate from the maker is submitted with each vehicle presented for licensing purposes, stating that it is in every respect similar to that already approved and respecting which a certificate had been furnished. It must be clearly understood that if, after the type has been passed, defects develop, which, in the opinion of the police commissioner, render it unsuitable as a type for public service, the commission reserves the right to withdraw such approval entirely, or until the defects have been remedied to his satisfaction.

3. A certificate from the proprietor, stating that there has been no alteration in the design of the machinery since the previous inspection and date covered by the maker's certificate, must be presented with each omnibus submitted for renewal of license. Should any alteration be made, full particulars of such must be stated and the same course may be required as for a first inspection.

4. Should it be deemed necessary, an expert will be employed to advise on the subject. The fee for the expert examination must be deposited by the proprietor with the commissioner, which fee will be returned should the vehicle be passed without alteration being required.

5. When making application for the vehicle to be inspected the proprietor must specify the route or routes upon which he intends it to ply, and these routes may not be departed from except after due notice has been given to the commissioner. (Note.—Nothing in this regulation shall be taken to prohibit a proprietor changing the route as often as he chooses, provided the carriage has been previously certified to be fit for such route.)

6. The following measurements and requirements for an omnibus with top-deck seats must be strictly adhered to. The number of passengers to be provided for on such vehicles must in no case exceed 16 inside and 18 outside; but if a less number than 30 be provided for, the number of passengers carried upon the outside must not be in greater proportion than seven outside to six inside.

7. Weight.—Omnibuses must be so constructed that the following maxima of weight are in no case exceeded:

Unladen	7,000 lbs.

Or if the manufacturer prefer—

Back axle weight, laden	8,000 lbs.
Front axle weight, laden	4,000 lbs.
Total weight, laden, not to exceed	12,000 lbs.

When the vehicle is fully loaded and in every respect ready for service, 140 lbs. to be allowed for each passenger as well as the driver and conductor.

8. If the weight is not distributed in the proportion of two-thirds to bear upon the rear axle, it must be so arranged or distributed that undue weight is not thrown upon the front, nor must the maximum of 6 tons be in any case exceeded.

9. Chassis Length—Not to exceed 20 ft.; but if the platform is to be constructed upon the frame the total length may be 23 ft.

10. Chassis Clearance—All the under parts of the vehicle inside the pivots of the front axle and steering arms (which must be placed as near as possible to the road wheels) as far back at least as the rear axle must clear the ground at least 10 inches when the vehicle is fully loaded, sufficient allowance in addition being made to provide for the wear of the tires, set of the springs, or other causes of lessened height, so that the minimum clearance of 10 inches is at all times maintained.

11. Chassis Springs.—Must be properly hung, of sufficient strength, and flexibility to meet all purposes which may be required of them. The rear springs must be attached to, or bear upon the back axle or axle casing as near to the road wheels as possible, and the distance between the outsides must not be less than 45 inches. Where a cross spring is used, it must be so applied that it shall not cause or increase side sway. The front springs must be as wide apart as possible, and not less than 38 inches from outside to outside.

12. Chassis Wheelbase.—Should not exceed 14 feet 6 inches, and it should in all cases be so proportioned that skidding or improper movements shall be as far as possible avoided. (Note.—If it is found that a vehicle is apt to skid or be otherwise improperly moved unduly, the commissioner reserves the right to serve a notice on the proprietor "not to use," and may refuse to license the vehicle again until the defects have been remedied.)

13. Chassis Wheel Track.—For both front and rear wheels should coincide, and the measurement from center

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to center, taken in line with the axles, must not be less than 5 feet 6 inches. In no case must the front track be less than the rear.

14. Chassis Road Wheels.—Must be of sufficient and suitable diameter, but not made so heavy as to throw an undue strain upon the steering gear or other parts.

15. Chassis Tires.—The material of which the tires are made must be soft and elastic so as to reduce vibration, etc. Sectional tires must not be fitted to a vehicle submitted for inspection and license.

16. Chassis Breadth.—The breadth must not be greater than 7 feet 2 inches at any part.

17. Brakes.—Each vehicle must be fitted with at least two independent brakes, each capable of stopping and holding the machine under all conditions. They must also, where necessary, be fitted with an approved form of compensating device. (Note.—The maintenance of the brakes in perfect order is of the utmost importance, and this will at all time be insisted upon. They will at any time be subject to inspection by police.) The brakes should, as far as possible, be so affixed as to be capable of easy adjustment, and at least one must be applied by a pedal. Brakes will not be deemed independent which are operated by pedals, or levers acting through the same connections, upon the same brake blocks, or upon the same brake drums, *and at least one must act directly upon the road wheels without any connection with the propelling gears.*

18. The operation of either brake must in no case declutch.

19. Vehicles which are intended to ply upon routes which have long or steep hills will be subject to a special test, and additional brakes or other fittings may be required.

20. Each vehicle must be capable of being readily steered and able to turn a corner without unduly interfering with other traffic.

21. The steering arms, and other connections thereof, must be of ample strength, and as far as possible protected from damage by collision.

22. The ball and socket joints of steering connections, when such are used, should not be pendent, but the longitudinal or transverse rods must be carried *upon* the ball.

23. All brake and steering connections secured with bolts or pins must have such bolts threaded and fitted with nuts, which latter must be locked or pinned. The whole of the brake and steering parts must be maintained in perfect order and will be subject to inspection at any time.

24. All parts connected by bolts, or studs and nuts, subject to severe vibration, must be fastened by lock nuts or by nuts and approved spring or lock nut washers, to prevent their working loose and causing noise, and any vehicle with lamp brackets or other fittings loose, and likely to cause unnecessary noise, will be regarded as unft for public service.

25. The machinery must be so constructed that no undue noise or vibration arises from its use. The maintenance of the carriage in a satisfactory condition in this respect will be *strictly* enforced.

26. Every new vehicle must be submitted at a time and place appointed, to be specially tested in respect of noise and vibration.

27. All omnibuses must be so geared that their highest speed shall not be in excess of the maximum allowed, viz., 12 miles an hour, or be fitted with an approved device which shall give a distinct and audible warning as often and so long as the speed of 12 miles an hour is exceeded.

28. When a vehicle is submitted for inspection the gear ratios must be supplied, and these ratios may not be altered without the authority of the commissioner. The revolution of the engine when running at the speed which will give 12 miles per hour with the stated highest speed gear must also be supplied.

29. The lubrication of the engine and the carburation of the working mixture must be so controlled that smoke shall not be emitted with the exhaust, or from any other part. Proprietors of vehicles not properly maintaining them in accordance with this requirement will be served with a notice "Not to use" until the defect has been remedied.

30. Carburetters or other gasoline receptacles, unless they are suitably encased or screened, must not be placed in close proximity to magnetos, or to connections of wires carrying electric current.

31. When a guard, tray, or under shield is fixed beneath the engine and adjacent machinery, it must be so constructed that any overflow of gasoline shall not be retained in the tray.

32. Suitable and approved appliances for extinguishing fire must be carried in such a position as to be readily available for use.

33. Tanks for gasoline, or other liquid fuel, must be made of suitable material, properly constructed, and of sufficient strength. They must be so placed that any overflow shall not fall upon woodwork, or accumulate where it can be readily ignited. The filling nozzle or inlet for the fuel should, where possible, be brought to the outside of the body.

34. All wires carrying electric current must be properly insulated and protected from injury, and so placed that they cannot be the cause of danger.

35. Effective means must be adopted for preventing the heat of the motor, generator or of the exhaust pipe connections, from injuriously affecting any parts of the vehicle or the comfort of the passengers.

36. The exhaust pipe must not be led inside the tray or undershield, or be fixed in such a position that oil, or any vaporizable or inflammable material, is likely to be dropped upon it.

37. The outlet from the silencer must not be so placed as to project the exhaust directly to the rear or on to the roadway, or be so placed, or so directed as to alarm horses immediately behind the vehicle.

38. The machinery must be so constructed or placed that oil or grease from the bearings cannot drop on

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to the roadway, and the maintenance of the vehicle in this respect will be strictly enforced.

39. When trays are fixed beneath the parts, they must have suitable webs for retaining the oil when ascending or descending hills, or be otherwise suitably constructed with that object. Oil or other materials collecting in the trays must be cleaned out frequently and not allowed to accumulate.

40. If requisite a bar or bars, having an eye or bridle to surround the propellor shaft, must be so fixed that in the event of either the shaft or gearbox breaking, other damage or danger therefrom is minimized.

41. Driving chains and sprockets must be protected by a suitable guard.

42. Body Camber.—The camber should not be more than 3 in., but may, if the proprietor so desires, be made up to, but not exceeding, 5 in., provided the outside of roof is so constructed as to give an equivalent in all respects to a 3-in. camber, and the maximum height from the ground is not in any way increased.

43. Body Height.—The height inside measured in the center line of omnibus from the top of the floor battens to the lower edge of the hoop sticks or other such projections must not be less than 5 ft. 10 in., nor be more than 6 ft. to the center line of roof-boards. From the ground to the spring of roof outside or edge of drip-boards, the height must not be greater than 9 ft., nor must the height to the outside center of roof be more than 9 ft. 3 in.

44. Body Breadth (Inside).—The width between seat backs must not be less than 56 in. when the seats are placed lengthwise.

45. Body Guard Rails.—The top of the side guard rails must be at least 3 ft. from the top of the roof battens at the side, and 18 in. above the highest part of the seat. The front and back rails must follow the camber of the roof and be at least 3 ft. 3 in. high when measured from the top of the roof battens.

46. Body Landing Board.—The space from the off hind roof seat, or any projection thereon (other than a commode rail not exceeding 3 in. deep) to the back guard rail, must not be less than 26 in.

47. Body Seats.—At least 16 in. measured in a straight line must be allowed for each passenger on every seat, which seat must be fit and proper and convenient for sitting on. When cross or "garden" seats are fitted either inside or on the roof, there must be at least 26 in. clear from the inside back of one to the back of the seat in front of it, so that there shall be room for the knees of passengers.

48. Body Platform.—The length of the platform for omnibuses with seats on top deck must in no case be less than 36 in.

49. No canopy or other similar superstructure will be permitted on the roof of an omnibus constructed to carry passengers on the top deck.

50. Corner pillars for bodies must be of sufficient strength, and the body must be properly ironed and stayed to give the necessary strength for the weight to be carried and to resist the effects of the vibration to which it is liable.

51. No seat will be permitted which, when occupied, is likely to cause obstruction to persons using the landing board or gangways.

52. The backs of all seats must be closed to prevent, as far as possible, the pockets of passengers being picked.

53. Where cushions are provided for seats, they must be covered with leather, cloth of good quality, rattan, or other suitable material. Inferior cloth, or any material of inferior quality, is not regarded as suitable for public carriages.

54. The steps for entrance to the inside and to the roof must be placed on the near side and at the rear of the carriage. They must be safe and convenient; suitable and efficient means being provided by rails or bands to assist passengers entering and leaving, and the lowest step must not be more than 15 in. or less than 10 in. above the ground.

55. The risers of all steps must be closed and the treads of each fitted with an approved form of tread plate.

56. The outer stringer of staircase must be so constructed, or a band is to be so placed, as to act as a decency screen to persons ascending or descending. There must also be an intermediate guard-rail, where necessary, between the hand-rail and the stringer.

57. No aperture must be left at the top landing board through which a passenger might inadvertently step.

58. There must be proper ventilation without the necessity for opening the windows, except where small separate ventilating windows are provided, in which case suitable provision must be made for the opening to be adjustable.

59. When the side windows are made to be lowered such provision must be made (by means of guard rails, or otherwise) that the arm of a passenger cannot be thrust through so as to be endangered by passing vehicles.

60. Some effectual means must be provided to prevent the rattling of window frames and glasses.

61. The vehicle must be suitably lighted inside and outside. Where acetylene or other gas is used, the cylinders or vessels which contain the gas, or in which it is generated, must be fixed outside in such a position as to be removed as far as possible from the danger of accidental ignition. The pipes are to be led along the outside, but not along the outside of the roof.

62. Head lights of great brilliancy will not be permitted.

63. A horn, gong, or other approved means for giving due warning of the approach of the vehicle must be provided.

64. Celluloid or xylonite fittings will not be permitted inside or outside the vehicle, but this does not apply to accumulator cells.

65. A box or other approved means must be fitted front and rear to exhibit the destination to which the vehicle is on each journey to proceed. The letters and

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background must be black and white, the letters of a height of at least 4½ in., and of a proportionate thickness.

66. The destinations and route boards are to be illuminated by night in an approved manner for the guidance of intending passengers.

67. The following particulars must also be suitably painted on the vehicle:

(*a*) The weight and rate of speed.

(*b*) The full name of proprietor, on each side clear of the wheels.

(*c*) The words "Metropolitan Stage Carriage," and the number of the number plate, both on the outside and inside. The writing outside to be placed behind the carriage on the near side.

(*d*) Fares must be painted legibly inside.

(*e*) The number of passengers which the vehicle is licensed to carry must be painted legibly inside and outside.

68. No writing or lettering in the form of an advertisement will be allowed on the front or rear of the vehicle in colors of black and white, or in such form or position as to hide, or in the opinion of the commissioner to interfere with the easy legibility of the destination indicators or route boards.

69. No printed, written, or other matter shall appear on the outside or inside of the carriage, or be carried by way of advertisement, except such, if any, as may be approved by the commissioner.

70. No person, except a learner, fitter, or other official when specially authorized by the proprietor (such person to carry a special pass or badge), or a person authorized by the commissioner, shall be allowed to ride beside the driver at any time.

71. No cans or other receptacles for oil, water, etc., are to be carried on the driver's footboard, nor may anything be placed in such a manner or position as will be likely to hamper the driver or otherwise give cause for complaint.

72. Each carriage must be fitted with an approved means for enabling passengers both inside and outside to signal to the driver or conductor when required.

Note.—Though the above conditions may have been complied with, yet if there be anything in the construction, form, or general appearance which, in the opinion of the commissioner, renders the vehicle unfit for public use, it will not be licensed.

The mayor of El Paso, Tex., is convinced that the 24 horses employed in the city's fire service are as inefficient as they are expensive to maintain, and should be replaced by motors.

The Renfrew volunteer fire company of North Adams, Mass., has installed a motor truck.

The secretary of the Milwaukee health department declares that horses are less numerous in that city by 60 per cent now than in 1908. This conclusion is based upon municipal statistics bearing upon the collection of stable refuse.

NOVELTY IN CAB DESIGN.

THE driver's compartment of the new motor cabs operated by the General Company in Paris presents a very interesting appearance. The steering pillar is placed at the left of the vehicle, while the brake and change speed levers are in the middle and convenient to the driver. This design is peculiar to the two-cylinder Clement-Bayard cab. Similar design is to be found in a few French trucks.

The Worcester (Mass.) Taxicab Company is defendant in a suit for $4,000 damages instituted by an employe who was injured while learning to drive one of the company's vehicles.

Automobile street rail cars are operating on the Third avenue line in New York City. The establishment of similar service is being considered in St. Louis.

The purchase of a motor hose and chemical wagon is being considered by the authorities of Manchester, N. Y.

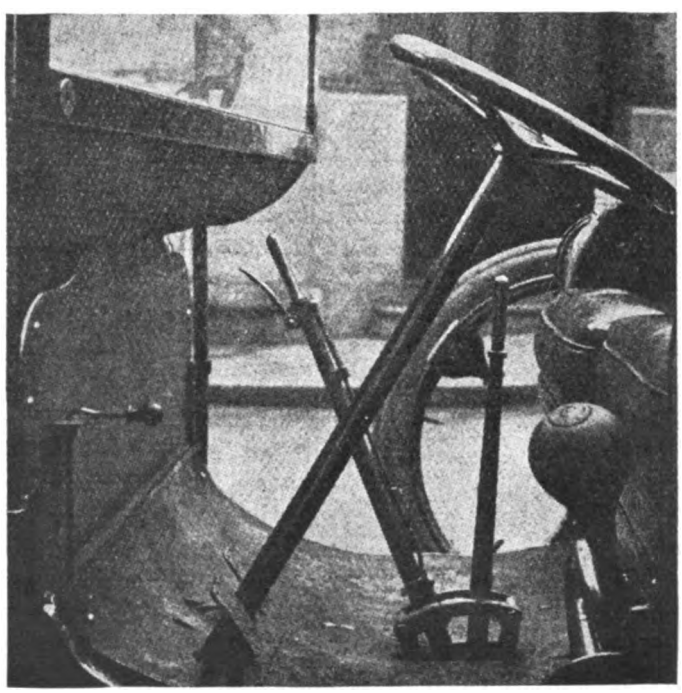
It is expected that the chief of Cincinnati's fire department will soon recommend the purchase of motor fire vehicles.

Passengers and mail are being carried in machines which operate between Petersham and Barre, Mass.

The public press in Cambridge, Mass., is urging the adoption of motor fire apparatus.

The Wilson volunteer fire company of Scranton, Pa., has decided to buy a motor hose and chemical wagon.

At the close of last August there were 3,950 licensed motor cabs in London. These machines are owned by 170 individuals or companies.



Example of central steer and gear control.

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Storage Battery Weight Efficiency.

Consideration of the methods by which it may be improved—New electrode formation proposed.

THE prospect for increasing the weight efficiency of storage batteries was very instructively considered in a paper read by Edward Sokal, Ph. D., at a recent meeting of the Society of Automobile Engineers, the author saying:

"I should divide the possibilities to increase the weight efficiency of the storage battery into three groups:

"1. Storage batteries of different chemical construction than the lead storage battery.

"2. Variations of construction, design and arrangement within the scope of the present lead storage battery type."

"3. Improvements on the present lead storage battery.

* * *

Gas Storage Battery Not Favored.

"I shall not have much to say about the possibility of improving the weight efficiency of the storage battery by using a different chemical material than lead. The reason for this is that, in my opinion, the possibility of obtaining a practical advantage in this way is so small that I would rather call it an impossibility. As a matter of curiosity, rather than anything else, I may mention here a fact that is not generally known, namely, that with so-called gas-storage batteries, in which oxygen and hydrogen occluded by finely divided, spongy metals, particularly platinum or palladium, with a suitable electrolyte, are used, it is possible to obtain a weight efficiency which is far superior to the weight efficiency of the lead storage battery and which can reach up to thirty and even thirty-five watt hours per pound. Such storage batteries have been studied in 1881 by J. Rousse, later on by Cailletet and Colardeau and others. There are a good many more or less obvious reasons which would render such a battery impracticable. The price alone of the materials employed—palladium being about ten thousand times as expensive as lead—makes it plain that the present storage battery manufacturers need not be alarmed about the competition of the gas storage battery.

* * *

State of the Edison Battery.

"A little less chimerical, but infinitely more pretentious, has been the career of the Edison storage battery, which, by the way, is not yet quite at its end, as Mr. Edison seems to expect from the use of cobalt the final achievement of the results which several years ago he announced as having been actually accomplished by other combinations. The utmost limit which has been obtained by Mr. Edison so far was about eleven watt hours per pound of element, which figure can be easily and quite appreciably exceeded by the lead storage battery. Whether further developments will improve the Edison storage battery up to the standard or even beyond the standard of the lead storage battery is something on which, of course, it would be presumptuous to express a definite opinion.

Why the Lead Battery Persists.

"On the part of laymen, and sometimes also from technical men, one can hear the question: 'Why does not somebody construct a storage battery out of a different material than lead, which metal, because of its great equivalent weight, seems to preclude right in the beginning the possibility of a really light storage battery?' Those who ask this question are usually very much surprised, and sometimes even shocked, if they hear the answer that while, of course, such a thing is not logically impossible, it may be said that it is practically almost out of the question. In order to devise a new storage battery the electro-chemist has at his disposal only a quite limited number of metallic and electrolyte combinations in existence, which have all, or practically all, been tried and investigated. There are also certain fundamental conditions of conductivity, reversibility, insolubility, etc., which limit the number of possible selections even further, not to speak of the not less important commercial consideration, namely, that the substances employed be generally accessible and of a reasonable price.

"We are all aware of the fact that the weight efficiency of lead storage battery cells, as they are manufactured now for electrical vehicle use, is by no means a constant figure, but, on the contrary, subject to quite considerable variations. To quote a rather conspicuous instance, I beg to mention that while the standard storage battery cells in this country are kept within nine to twelve watt hours per pound of total element, the storage battery cells abroad, particularly in Germany, do usually reach an appreciably higher weight efficiency up to seventeen watt hours per pound. This is not due to a higher state of storage battery art in the old country, but rather to different conditions in the electrical vehicle business, which make it advisable for the vehicle manufacturer over there to use exceedingly thin plates in a good many cases, particularly for pleasure vehicles, even at the sacrifice of life.

* * *

The Rubber Jar Is Not Satisfactory.

"How to improve the weight efficiency of the lead storage battery for electrical vehicles within the scope of its present general type? The container, as all know, is hard rubber; I should rather say that it is supposed to be hard rubber, because, likewise, as all know, there are a good many hard rubber jars in use which contain hard rubber practically only in their name. Be this as it may, we have no choice; there seems to be no other suitable material. Celluloid is too dangerous, which is very regrettable, because it is light and very plastic; outside of its inflammability it is objectionable because in time it disintegrates by the action of sulphuric acid. I believe the vehicle manufacturers will agree with me that it is the rubber jar which causes the greater percentage of troubles in the operation of electric vehicles, particularly in small

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cities, where the jars are easily broken but not easily replaced. I may be mistaken, but I have had considerable evidence to that effect. An iron jar covered with an impervious layer of rubber, or some other similar material, would be a good thing in itself, but, of course, it would not diminish the weight. There is no hope for an improvement of weight efficiency by a change in the container.

"The connections between the elements can be made out of copper instead of lead; in such case they weigh less, have less resistance and improve the weight efficiency a little. They are evidently not practical for ordinary use, as they would corrode in practically no time.

* * *

Increase of Electrolyte Temperature.

"The electrolyte in storage battery cells for electrical vehicle use is now usually kept at 1,300 specific gravity, and it would be neither advisable, nor even temporarily useful, to keep its concentration higher, because the conductivity of the electrolyte drops appreciably beyond this point, and also because acid of greater strength directly attacks lead and disintegrates the negative plates. A quite appreciable increase of capacity, and therefore of weight efficiency, can be obtained by the use of electrolyte of higher temperature. The increase of temperature has an effect on the diffusion of the electrolyte, which it accelerates, and at the same time it improves the conductivity; at quick discharges particularly the gain of capacity can be quite considerable and varies from one to two per cent per centigrade against the capacity at 14 degree Celsius. It has been proven by reliable experiments that warm electrolyte has a bad effect on the life of the plates; still, in my opinion, it remains an open question whether this bad effect is caused by discharging, or only by charging, with warm electrolytes, and while the total life of a storage battery cell with heated electrolyte might be diminished, it does not follow that the total number of ampere hours which could be taken out from it would not be greater than with ordinary electrolyte.

* * *

The Advantages of Thin Plates.

"Of storage battery plates of the present general type there are two variations which are known to have an appreciable influence on the weight efficiency, namely, those elements which have a certain influence on the life of the plates. There is no doubt, generally speaking, that a porous or thin plate, other conditions being the same, will have a shorter life than a plate of less porosity and greater thickness. It can be stated, however, as a result of a very extensive observation, that of these two means the diminution of the thickness of plates is decidedly the better one. Making the plates thinner facilitates the diffusion of the electrolyte just as the increase of artificial porosity does. Besides this, however, making the plates thinner diminishes the electrical resistance of the electrode for a given weight, and does not deteriorate in itself as quality of active material, which is undoubtedly the result of great additions of artificial porosity agents. On the other hand, I do not want to be put on record as advocating generally the use of thin plates. I believe that nearly every case of storage battery application is a special engineering problem, and that such questions cannot be decided generally.

* * *

Positive Plates Might Have More Capacity.

"In the present vehicle-storage battery the negative electrode has a very much greater capacity than the positive, which finds its simple expression in the fact that there is always one more negative than positive plate in an element. In my opinion this is an arrangement which has been taken over from the stationary field of storage battery engineering by mere routine, and is not very well justified by the actual condition of electric vehicle service.

"The conditions are very different in vehicle work, where the batteries are exposed to considerable mechanical wear and to much misuse on the part of vehicle owners and more or less incompetent garage men, and, therefore, particularly in view of their comparative lightness, they cannot be expected to last nearly as long as stationary batteries. In the case of the electric vehicle batteries it is usually the positive which gives way first. It would, therefore, seem only logical to strengthen what is the weak spot and give to it more capacity than it has now, while at the same time diminishing the capacity of the negative set. The simplest, but by no means the only way of accomplishing this is to build cells with one more positive than negative. The relative dimensions and proportions of the two sets in such an arrangement can, of course, again be varied in a good many ways, according to whether one wants to obtain an element of greater durability than the present one, or simply an element in which the positive and negative set would give way at about the same time, or, again, an element with a greater weight efficiency. Mostly with the last purpose in my mind, I have constructed elements with one more positive than negative, and have been able to obtain from 10 to 15 per cent increase in weight efficiency. I am submitting this suggestion for further experiment.

* * *

Other Methods for Increasing Weight Efficiency.

"Another way which has been suggested and tried repeatedly for the purpose of improving the weight efficiency is the diminution of the weight of the grid of pasted vehicle plates in proportion to the active material which it contains. The proportion of grid weight to the weight of active material is now in standard plates about one to one, sometimes two to three, and hardly ever goes any further in favor of the grid weight. It is hardly possible to change this proportion appreciably without affecting seriously the mechanical strength and durability and also the conductivity of the plates. In the present pasted vehicle plates the grid has a double function; it serves as support and retaining means for the active material and also as electrical conductor. If it would be possible to eliminate the first function and to use the grid exclusively as electrical conductor it could obviously be made much lighter. Such attempts have been made in certain plate constructions in which the active material is pasted into some very light porous retainers, made of porous clay,

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and in which the interposed lead sheet serves only as conductor, and therefore can be comparatively very light. This idea is very tempting, particularly as at first sight it promises to do away with the shedding of the positive active material and to retain this material securely locked in its place. Such devices are about as old as the history of the storage battery. The expectations of their more or less sanguine designers, however, have not been fulfilled in practice.

* * *

Fundamental Causes of Poor Efficiency.

"Now, then, what is the real and fundamental reason of the comparatively poor weight efficiency of the lead storage battery, particularly at high discharges? According to what we just said, if a storage battery is discharged at a high, or even normal, rate of discharge down to its limit, there still remains on the positive as well as on the negative electrode a very great part of active material which does not enter into action, and in order to bring even a small portion of that remaining material into electrical operation we have to select means which are more or less injurious to the life of the plates, as making them very thin, very porous, etc.

"The cause is a very simple one, although it has been fully understood and explained only within the last ten years. The galvanic, spongy lead—lead peroxide—has a practically useful electromotive force only with sulphuric acid down to a certain concentration limit. Now, during the discharge of the storage battery the electrolyte enters a chemical combination with the positive and negative active material, and its concentration, as measured by specific gravity readings, drops quite appreciably during the discharge. The concentration obviously drops even much more considerably within the pores of the active material, where the chemical reaction takes place, than in the surrounding electrolyte. The only factor which counteracts this difference between the concentration of the electrolyte in the pores of the electrode and its concentration in the container is the natural diffusion. Sooner or later, and at high discharge rates obviously much sooner than at slow discharge rates, a point is reached where the concentration of the electrolyte has dropped within the pores below the limit necessary to give a useful electromotive force. An interesting fact which corroborates these statements, and which is known to every user of storage batteries, is that batteries which have been discharged at a high rate to the full limit of their capacity are able to recover and show a higher voltage, and quite an appreciable remaining capacity, after resting for a certain length of time and after the diffusion of the electrolyte has had time to raise its concentration in the pores of the electrodes. Lack of electrolyte of suitable concentration in the pores of the active material is, therefore, 'the' reason of the poor weight efficiency of the lead storage battery.

* * *

Another Method for Improving Efficiency.

"This leads me to the third possibility of improving the weight efficiency of the lead storage battery. For several years I have been working on the problem of producing a battery in which the concentration of the electrolyte within the pores of the electrodes would be kept constant by causing a continuous flow of the electrolyte through the pores of the active material by pressure or similar means. The difficulties first seemed insurmountable, as there is nothing in the customary arrangement of storage batteries which at first sight seems to suggest the employment of a device for artificial circulation of the electrolyte. I have succeeded in overcoming the fundamental difficulties by constructing hollow or bottle-shaped electrodes, through the walls of which an artificial circulation of the electrolyte takes place. In this way a gain in capacity of 50 to 100 per cent can be obtained. In the construction of this pressure battery intended for electric vehicle use the elements are practically self-contained. They are carrying the electrolyte within themselves, and therefore would need rubber jars, or similar devices, only inasmuch as the purpose of insulation and separation would make it necessary, but not as containers for the electrolyte."

INGENIOUS LICENSE NUMBER LAMP.

SINCE all motor road vehicles must carry license numbers, and it is found good policy to equip them with tail lights, a fixture which will serve for both purposes is naturally of considerable interest to the owners of such machines. The Jordan Equipment Company, of Beverley, Mass., is making a combined rear light and number holder, the shell of which is of lacquered brass, opening at the bottom, as shown in the accompanying illustration, to permit cleaning of the reflector.

The lamp feature of the device contains a tungsten electric bulb which is held in place by spring cushion sockets at each end. The bulb can be removed by pressing either spring. Vibration cannot jar it out of place. The heavy ground glass runs the full length of the under

Electric license number lighting device.

part of lamp, thus making a well-diffused white light which completely illuminates the number and projects a beam or bar of light to the roadway, which is a protection from rear collision. The device is attached by means of two screw bolts to the body or frame of the vehicle. The switch should be located conveniently to the driver.

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PROFITABLE GOVERNMENTAL ENTERPRISE.

DURING the present year the 17 motor mail and passenger routes operated by the Bavarian government yielded a profit of about $19,000. About 256 miles of territory is covered by the machines. The rolling stock consists of 50 vehicles for the conveyance of passengers, with 33 trailers, and 6 freight motors with 15 trailers. The total number of passengers carried amounted to over 600,000. The popularity of the passenger carrying vehicles may be inferred from the fact that on one line the traffic was 27 times as great as the horse traffic which it replaced. The freight carried by the motors amounted to 9,000 tons and included live stock, food supplies, furniture, agricultural produce, coal, etc.

WINTER STUDIES FOR AUTOMOBILE ENGINEERS.

THE Society of Automobile Engineers is to be congratulated upon the attention which it has recently given, and in future proposes to give, to subjects relating to the efficiency and economy of commercial motor vehicles of all kinds. During the coming winter season papers will be read before the society upon the following topics: "Requirements and Operating Cost of Motor Cabs," "Independent Unit Railway Cars," "Motor Truck Tires," "Relative Efficiency of Four-Wheel Front and Rear Drive of Commercial Vehicles," and "Commercial Vehicle Depreciation."

A motor truck has just been produced abroad which pulls a five ton load for ten miles on a gallon of gasoline. The engine is rated at 35-40 hp.

A committee of taxpaying citizens of Greenville, N. Y., has been appointed to confer with the mayor concerning the purchase of a motor hose and chemical wagon.

Several of the councilmen of Newcastle, Pa., favor the installation of motor driven fire apparatus.

THE AMPERE-HOUR METER.

ERNEST LUNN, in charge of the electric wagons owned by the Commonwealth Edison Company in Chicago, thus enumerates the advantages of the ampere-hour meter:

1. It enables the driver to see at a glance how much of his battery capacity has been used up at any time.

2. It enables him to get an ampere-hour test on his battery every time he runs his battery out.

3. In commercial work it prevents the lazy driver from lying about the amount of charge left in the battery. Anyone who has had to do with motor truck drivers knows very well that they have a habit of saying they have not sufficient capacity left in the batteries to make another trip, especially if it is along about 4 o'clock in the afternoon.

4. It gives the best kind of a check on the charge, provided the battery is charged on a voltage or gravity basis.

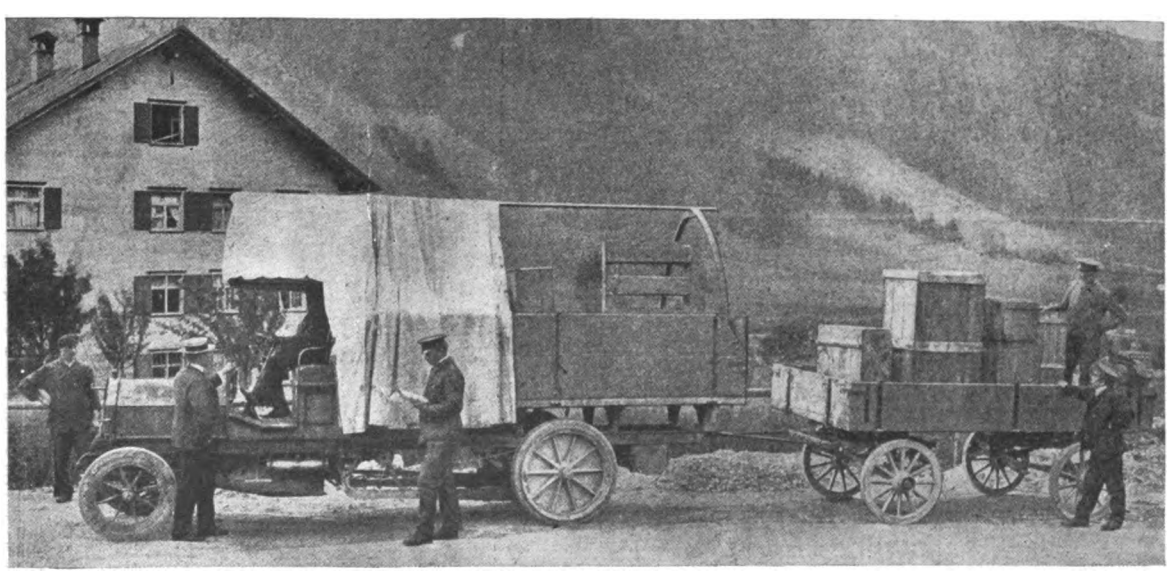
5. It has so far shown that it is a reliable meter to govern the charge, no other instrument except the regular volt-ammeter mounted in the switch board being necessary. This does not mean that the usual gravity readings should not be taken as a rule.

6. It enables the owner who keeps his rig in a public garage to determine whether he is getting his battery fully charged.

7. It enables him, with the automatic cut-off device, to keep his vehicle in his own barn with comparative safety.

These are a few things that it can do. It is a question whether an instrument with so many virtues will be able to survive.

Money is being raised by popular subscription in Woodbury, N. J., for the purchase of a 70 hp. motor fire vehicle which is capable of throwing 700 gallons of water a minute. It has been ascertained that the maintenance cost of the machine will not exceed 17 cents a day.



Freighters operated by the Bavarian government.

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BOSTON-CHELSEA MOTOR MAIL SERVICE.

AN electric wagon is transporting mail matter between the Boston central postoffice and Chelsea. The machine makes the round trip in an hour. Horse-drawn wagons require an hour and a half for the journey. The new service is being furnished by Whipple & Company, who hold the mail carrying contract. The change in equipment has been made under sanction of the government. The Boston postmaster is so well pleased with the service of the motor wagon that he is considering the replacement of the 28 horse-drawn wagons now employed in that city. The machine's service will be continued for some time in order to thoroughly demonstrate its value. Its cost was $2,500. It is equipped with large wheels and a single motor.

MOTOR ROAD TRAINS.

PRACTICAL experience with motor road trains of the Renard type, both here and abroad, make it seem certain that the cost of operation, all charges included, does not exceed 4 cents a mile when full loads are carried both ways. It will be remembered that such trains are made up of a tractor, which at discretion may haul some of the load upon its own platform, and as many self-propelled trailers as may be necessary, the latter being steered from the tractor in whose path they accurately follow.

Many drivers of motor cabs in St. Louis earn $120 a month in salary and tips. In addition, one of the companies gives its men a bonus for the skill and care they exhibit in handling their machines.

Motor cabs are operating in Mexico City, and the service is very popular.

The machines of the Federal Taxicab Company in Washington, D. C., recently earned $1,800 in one day. Ninety-six men are employed for all purposes.

ECONOMY OF GAS-ELECTRIC TRUCK.

EVEN allowing for depreciation and interest on investment, the former of which may safely be calculated at 15 per cent and the latter at 6 per cent, and apportioning a reasonable sum for maintenance expense, it is still quite evident that the gas-electric truck is far more economical than its equivalent of horse drawn vehicles. The following table shows the expense of operating a three-ton machine of this type for the first 25 days after installation:

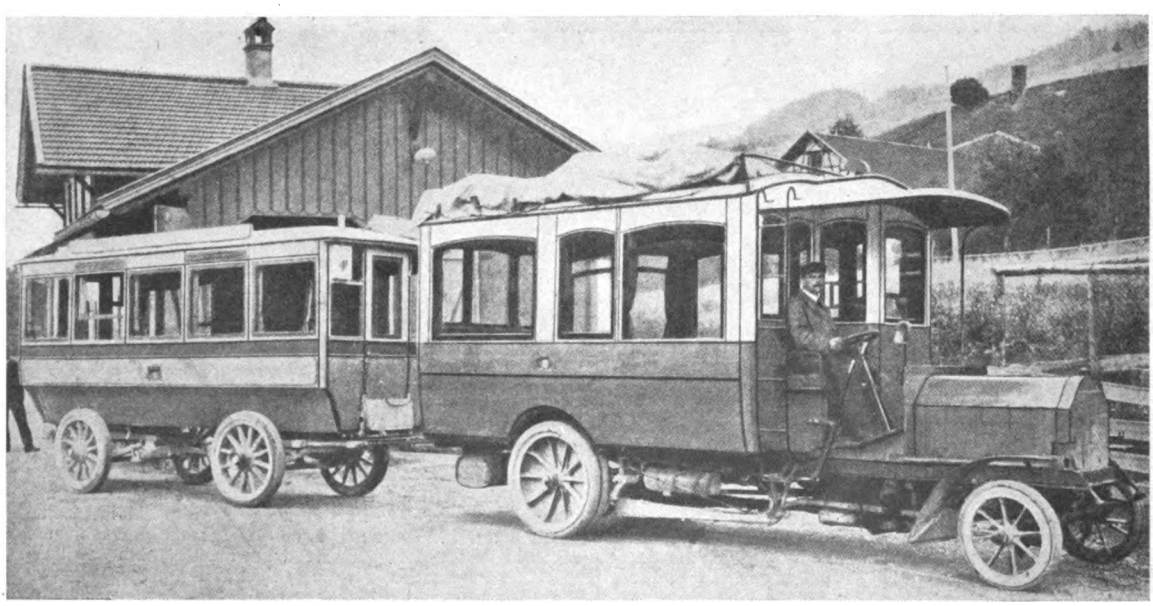
Wages of 2 men at $4.25	$106.25
262 gals. gasoline at 11½ cents	30.13
10 gals. cylinder oil	4.50
	$140.88

The load during this period was 1,416 barrels of flour, to haul which by horses would have cost $283.20. There is thus a gross saving of $142.32, or a commortable margin of 50 per cent out of which to pay for wear and tear, mechanical upkeep and the other incidentals of administration. The machine in question, made by the Couple Gear Freight Wheel Company, is performing work for the Southwestern Milling Company.

The Palmer-Hawkins Rubber Tire Co., of Akron, Ohio, has just equipped a motor truck with a set of its sectional tires measuring 36 by 10 inches. It is believed that this is the largest set of solid rubber truck tires ever manufactured or applied in the United States, if not in the world. The truck will be used in Florida, where the sandy roads renders the use of an ordinary tire impossible.

The Beaufort Auto Transfer Company has been organized in Charleston, S. C., with capital stock of $5,000.

The Twin City Taxicab Company has been organized in St. Paul with capital stock of $600,000.



Passenger and mail machines operated by the Bavarian government.

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Motors vs. Horses

Press opinions which indicate the popular interest in mechanical road haulage.

The Motor Hearse.

EVERY time a new use is found for the automobile we are confronted with the old story of the death knell for the horse. But now comes an innovation that bears a funeral note sure enough. It is the automobile hearse.

In St. Louis the undertakers are considering the use of automobile hearses and automobile carriages for the funeral procession. Poor old Dobbin has become too slow even to hold his own in the funeral train. With the automobiles the undertakers claim they can make four trips each day to the cemetery instead of two. Automobile hearses and funeral carriages have been tried in certain eastern towns and, with the undertakers at least, have proven popular.

To the cemetery via the honk, honk wagon! Is the slow and solemn procession to give way to modern methods of speed and hurry? It remains to be seen. We have become accustomed to revolutions of time honored customs and traditions, but the horseless hearse takes the blue ribbon.—*Joplin (Mo.) News-Herald.*

* * *

Prejudice and Ignorance to be Overcome.

IT has been practically ten years since any engineering or deviations from transportation rules have been necessary in order that merchandise in big cities might be moved at a more economical cost than could be accomplished by the use of horses. This is ascribed more to a tendency of commercial laws toward evolution rather than revolution. In the event of the latter it would be hard to conjecture the conditions that might have ensued, especially had the public discovered the advantage of auto truck transportation and sought its immediate application.

Well informed students of commercial matters ascribe this seeming tardiness to a lack of education on the part of those who must of necessity move large quantities of merchandise in the course of business affairs.

The maintenance of horses, vehicles and drivers constitutes the principal item of expense in all delivery businesses, especially in this immediate vicinity. Comparison tends to show that there are few established delivery institutions in any city that could not effect a saving of at least $5,000 per annum at a comparatively small additional outlay. This has been true for ten years.

Of course the saving in application of auto power instead of horse power hinges as much upon the intelligent application as upon the correct system of maintenance. Owing its commercial supremacy to its labor saving qualities, unless its application is made intelligently with the latter it fails of its purpose. A man with a given amount of clothing business who would substitute six sewing machines for six sewing girls would indeed be an idiot. If, through ignorance, stupidity, or, worse yet, mental habit or tradition, the power wagon is applied so that no labor is saved, then nothing is gained.

The unthinking public guides its mental footsteps by dogma. They do not recognize the existence of mental habit, yet every act of 90 per cent of the population is directed by mental habit.—*Louisville Courier.*

* * *

Power Wagons in Army Service.

THE fact that our own and many foreign governments are replacing the horse and truck with high power motor vehicles, not only as an aid to more expeditious transaction of business, but because the transportation of heavy materials is made less cumbersome, proves the utility of the machines.

The use of horses was discontinued in heavy hauling as soon as it was demonstrated that the auto truck afforded a more expeditious as well as economical mode of transportation. Despite the fact that in both the American and German army a motor truck is required that will operate successfully, retain its traction power and withstand the strain of rough going, these have proved a great advantage over the freight teams.

An ordinary army supply wagon, drawn by four mules or horses, carries a maximum of 2,500 pounds. One animal going lame or one wheel becoming stuck puts the entire equipment out of commission. A motor truck, as demonstrated in European armies, as well as in our own maneuvers, can carry twice as much and will go three times as fast with a tenth the risk of becoming disabled. It costs less to run and does away with the necessity of dividing the load between supplies for troops and feed for so many horses or mules.

The largest army motor truck occupies but twenty feet of road space, or about a third of that required for a team capable of drawing but half its load. It is needless to point out the general commercial advantages to be derived from this condition, especially in point of relieving congestion about those centers from which emanate a large amount of merchandise awaiting transportation, either to or from the store.

The use of the motor truck also serves to relieve the congestion along the main thoroughfares of any large city. Its ease of operation, traction power and carrying capacity enable it to thread a maze of vehicles and land its cargo with greater celerity than could be hoped for either from a four or six horse team.—*San Francisco Call.*

* * *

The Importance of Mechanical Road Transport.

THERE is probably no department of the modern merchant's business that is more important, both from a financial and from a service standpoint, than the transportation of his goods.

In bulk, to and from his place of business, the present facilities are adequate, but in the individual distribution of small packages to the customer, the average merchant of today is using a means of transportation that has been in vogue for the last 2,000 years, and he depends almost entirely upon animal power.

Investigation has shown that in some lines of business this cost of individual package transportation equals 40 per cent of the net profits.

When mechanical transportation is installed it has been proved that this cost of transportation is reduced fully one-half over a given route. This is without any consideration of the increased range of the motor car and the larger territory that can be supplied.—*Oklahoma Times.*

Two motor hose and chemcial wagons will probably be purchased by the authorities of Lynn, Mass.

The Taxicab Company of New Orleans is defendant in a damage suit for $5,000. The complainant is a woman who was injured by one of the company's machines while standing at a street intersection.

Residents in one of the unprotected districts of Portland, Me., are urging the purchase of a motor hose and chemical wagon.

One of the volunteer fire companies in Lebanon, Pa., has decided to buy motor fire apparatus.

The chief of the fire department in Ipswich, Mass., has recommended the purchase of motor apparatus.

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MOTOR CAB EARNINGS.

TRAFFIC earnings of the machines operated by the largest of the motor cab companies in London are given below:

Week ending October 2	$75,945
Week ending October 9	80,659
Week ending October 16	79,459
Week ending October 23	81,467

Receipts of this company from August 1, 1909, to October 23, 1909, amounted to $846,499. As remarked when presenting such earnings on previous occasions it is of more importance to know the income obtained from individual machines than the revenue from a fleet whose number is not declared. The publication of gross earnings, however, has the useful effect of establishing the practical character of motor cab service as well as indicating its volume.

LEGAL HORSE LOADS.

CHICAGO'S aldermen have been asked to consider a measure which provides for the fixation of the load that may be placed on vehicles drawn by horses or mules. By the terms of the bill vehicles drawn by one animal will not be permitted to carry more than 3,500 pounds, while two or more horse or mule drawn vehicles may carry 4,000 pounds for each animal.

The street cleaning authorities of Vienna are experimenting with a motor vehicle which is fitted with a chain driven rotating brush that sweeps dirt, loose stones and dust toward a vacuum conveyor operated by the engine. The refuse so picked up is automatically distributed to different steel chambers which, when filled, are hoisted off the vehicle platform by a crane which is also operated by the engine. It is believed that 40 of these machines would effect an annual saving of $50,000.

A BULKY LOAD.

THE haulage of light and bulky merchandise by motor wagon frequently makes it necessary to enlarge the carrying area of the vehicle. A good example of the ingenuity which may be shown in devising accommodation for large loads of this character is seen in the illustration presented below, a Packard machine employed in New York service. The platform over the driver's head serves as a protection from inclement weather and may very conveniently be enclosed with storm curtains. The picture will at once suggest the economy of the machine, the inclined platform down which the merchandise is slid making it quite apparent that very little time is wasted at the loading terminal.

PHILADELPHIA'S SHOW.

UNABLE to assign space to all wishing to exhibit at the Philadelphia show, the officials have decided to keep the doors open for two weeks, beginning January 17. During the second week industrial vehicles will be on view, as well as products for which no accommodation can be provided in the first week of the show.

Only 14 machines were entered for the Austrian trials, which lasted for a fortnight.

The Paris police are apprehensive of another ear-splitting outbreak by the motor cab drivers, who vent their wrath at any grievance by concerted horn-tooting. The last demonstration nearly drove the police crazy and set all Paris laughing. Angry at a magistrate who had fined several of their number, the 2,000 chauffeurs motored in a body to his home. Two thousand motor horns shrieked and 2,000 pairs of lungs yelled for a half hour. All the police could do was to prevent the judge's house from being invaded.

Packard truck with large platform area. Note the time-saving loading device.

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MOTOR FUNERAL PROCESSIONS.

THE Undertakers' Association of St. Louis in meeting recently decided to take measures looking to the exclusive use of motor vehicles in funeral processions. A committee was appointed to further this policy. The president of the association says: "I am heartily in favor of the move, and I predict that within 12 months motors will be used generally as hearses in this city. It is bound to come. We use motor cars for everything else. Speed is not the reason for our wishing to change. It is economy and comfort."

MOTOR MAIL WAGONS FOR COLUMBUS

NEXT January motor mail collection wagons will be installed in Columbus, Ohio, the postal authorities at Washington having sanctioned the service. Three machines will be installed at the outset. The Columbus post-office is now served by 11 horse-drawn wagons. The sum of $300 per annum is allowed each collector for care of his vehicle and horse. Five of these collectors will be dispensed with when the machines go into action. The service of the motor wagons and their drivers will, as usual, be leased by the government.

CHANGE OF FIRM TITLE.

WITH the object of avoiding business conflict, the Auto-Car Manufacturing Company of Buffalo will hereafter be known as the Atterbury Motor Car Company. A good deal of confusion has been caused by the similarity of the Buffalo concern's title to that of the Autocar Company of Ardmore, Pa.

A London driver-owner of a motor cab, who has operated his vehicle since March, 1908, finds that in 18 months he covered 32,947 miles, averaging 88 miles a day. During that period the cab was abstracted from service for 26 days for overhaul and repairs. The fuel consumption averaged 22 miles to the gallon. The tire cost was 2.6 cents a mile. The machine is equipped with a 10-12 hp. two-cylinder engine.

MACHINE DOING WORK OF FOUR TEAMS.

FOR three months past the Kansas City Structural Steel Company has been operating a three-ton Frayer-Miller truck between Kansas City, Mo., and its plant, which is located 6⅓ miles away. When the machine was first purchased a seemingly exaggerated estimate was made of its capacity, but in actual service it has developed that it is being worked with more economy and activity than either the owners or makers anticipated. At the outset it was represented to the manufacturers that it might occasionally be necessary to haul steel beams 35 feet in length. It is common to find the machine loaded with 50 and 60-foot beams. The picture shown below represents the vehicle hauling a 52-foot beam. The truck makes four trips a day between the plant and the city. Going to the city the loads average between 3½ and 4 tons. On the return trip factory materials, weighing from 1½ to 3 tons, are hauled. Thus far expenses for repairs have been exceedingly light. The machine is performing work which formerly required the employment of four teams.

MOTOR DELIVERY IN VINCENNES, IND.

LAST month a motor delivery service was organized in Vincennes, Ind., by the Johnson Auto Company. Three 22-hp. machines are employed. A charge of ten cents is made for each parcel delivered to any part of the city. Coupon books are issued to merchants requiring the service of the machines. The company also operates motor cabs and livery automobiles.

Collision with an interurban trolley car wrecked a municipal ambulance in Dallas, Texas.

Ten freight and ambulance motors have been purchased by the Austrian army. These machines will be used to transport ammunition to the troops at the front and carry the wounded to the rear. The freight load of each machine is 2½ tons, while the passenger load is four men on stretchers or twelve who are not urgently in need of medical attendance.

Frayer-Miller truck loaded with steel beams.

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MOTORCYCLES FOR FIRE RESCUE WORK.

THE director of public safety in Pittsburg is considering the employment of motorcycles for the rescue of people who may happen to be imprisoned in burning buildings. By stationing one of these speedy machines at each engine house, a driver who is able to fling a weighted coal of rope as skillfully as a telephone lineman could quickly reach the scene of a fire and send a rope ladder up to the fourth or fifty story of a building. In a pinch the weighted rope itself could be used as a means of descent.

ANOTHER MOTOR CAB MERGER.

TWO motor cab companies operating in Memphis, Tenn., have been merged. The services of the Corbett Taxicab Company and the Taxicab Company of Memphis have been combined, and will hereafter be administered by a new organization bearing the title of the latter concern. The deal was effected through the influence of the Thomas Motor Car Company, of Buffalo, which is strongly interested in the new organization. The equipment of the Corbitt Company will be disposed of and none but Thomas cabs operated in the future.

TO INCREASE CHICAGO CAB RATES.

A BILL was recently introduced into the Chicago council for the purpose of abolishing the hour tariff for motor cab service, except by special contract, and fixing new rates. The measure provides for the following rates: For the first one-half mile, or fraction thereof, 40 cents; for each one-fourth mile thereafter, 10 cents; for each four minutes of waiting, 10 cents. The present rates are: 50 cents for the first mile, or fraction thereof; 10 cents for each quarter, and 10 cents for six minutes of waiting.

The council has passed an ordinance requiring all motor cab drivers to obtain licenses from the city.

A pneumatic suspension for the chassis has been invented abroad. The device consists of four cylinders attached to the frame, their pistons being connected to the axles by ball-jointed links. Air pressure is maintained by a motor driven pump. The air inlet valve to each cylinder is controlled by the piston, through a coil spring and oil-filled dashpot. Ordinary road shocks do not affect the valve, but a steady load opens it and lets in more air, raising the frame to normal position. The pistons are lubricated and sealed by a layer of oil in their heads, maintained by oil carried by the incoming air.

The mayor of Newton Center, Mass., has recommended the purchase of a motor fire vehicle at a cost of $5,500.

The Austrian government has ordered two 90 hp., six cylinder vehicles which will be used to carry guns weighing up to 20 tons. It also owns 30 motor gun-wagons which were built for mountain service, all four wheels being driven. These machines can negotiate an 18 per cent grade with a 20-ton gun load.

MAGNETO FOR DUAL IGNITION.

In connection with the latest type U. & H. magneto intended for dual ignition, imported by the J. S. Bretz Company of New York, an improved form of high tension switch, which is mounted integral with the coil box, is furnished. Both ignition systems operate through the same set of spark plugs, thus avoiding the fouling of the idle set. The battery timer is incorporated directly within the magneto. The coil, located on the dash, is in use only when battery ignition is being employed. With the switch in the proper position for magneto ignition, the coil on

the dash is not in use, and the magneto is furnishing a true high tension arc flame spark. This system is particularly valuable for motors which are too large to be easily cranked for starting on the magneto, and in permitting the motor to be started directly on the spark, without cranking, and switching over to the magneto as soon as the motor is operating. The magneto is furnished with an interrupter, which never requires adjustment, being so constructed as to make tampering with its adjustments, and consequent trouble with the ignition. impossible. A timing pin for setting or timing the magneto with the motor is supplied. A new form of distributor is also employed.

MORGAN COMPANY'S CAPITAL INCREASED.

THE R. L. Morgan Company, making motor trucks in Worcester, Mass., has increased its capital stock from $300,000 to $1,000,000. Half of the new capitalization is 7 per cent cumulative stock, and the remainder common.

The fire chief of St. Louis is endeavoring to persuade the mayor and the comptroller to sanction the purchase of a motor fire engine which would give temporary protection to three outlying settlements. The machine would cost $8,000 and the crew to serve it $3,000 a year.

A traveling salesman recently chartered a motor cab to run from Atlanta to Savanah. The fare was $40.

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DEC. 31 to JAN. 7

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All Foreign Cars
All Accessory Makers
Taxicabs
Commercial Vehicles

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FORTY-THIRD ST. AND LEXINGTON AVE., NEW YORK

Admission, 50c. Tuesday, $1.00

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WILL PRODUCE TRUCKS IN CINCINNATI.

PROMINENT business men of Cincinnati have organized the United States Motor Truck Company. The authorized capital of new concern is $100,000. Alfred Hill, president of Page & Hill, is to be the president of the concern, and Herman Erdman, of the Fifth-Third Bank directorate, will be vice-president. Harry Manss is to be treasurer, and Jesse Lowman, an attorney, is secretary. There are only two others in the company, James Orr and W. C. Hedges. E. C. Shumard, formerly with the Special Motor Vehicle Company, will be the superintendent. Vehicles of all ratings will be manufactured.

SUCCESSFUL YEAR FOR KNOX COMPANY.

AT the close of its fiscal year of business the Knox Automobile Company, which makes commercial motor vehicles of all kinds at Springfield, Mass., declared a 4 per cent dividend on preferred stock, payable on November 1. The annual report showed that the company's affairs were in such a flourishing condition as to justify the expenditure of $40,000 for the erection of new buildings and increase of plant equipment.

TO ORGANIZE FOR MANUFACTURE.

EFFORTS are being made in Saginaw, Mich., to organize a motor truck manufacturing company. The experimental performance of the model recently produced by the local firm of Toeppner Bros., has attracted the attention of a number of business men who, in conjunction with the board of trade, are endeavoring to form a company for its production in quantity.

NEW INDUSTRY FOR LEICESTER, N. Y.

THE plant of the Buffalo Auto Truck and Motor Company will be located in Leicester, N. Y. A large concrete building located on a two-acre tract is being equipped for production. The officers of the company are as follows: President, John F. White, of Mt. Morris; vice-president, Mr. Gunell, of Buffalo; secretary, P. M. White, of Buffalo; treasurer, E. L. Toy, of Buffalo.

E. S. KELLY SECURES LEAR PLANT.

CONTROL of the Oscar Lear Automobile Company, of Springfield, Ohio, has passed to E. S. Kelly, the wealthy solid rubber tire maker. As soon as the receiver is discharged the capital stock will be increased from $200,000 to $500,000.

The Washington Taxicab Company has been formed at Spokane, Wash., with capital stock of $200,000.

TIRE PATENT INFRINGEMENT SUIT.

SUIT was recently brought against the Rapid Safety Filter Company of New York City for infringement of the cushion tire patent issued to Edwin B. Cadwell, the manufacturing rights to which have been exclusively granted to the Swinehart Clincher Tire & Rubber Company. The infringing tires were made by the Motz Clincher Tire & Rubber Company. The Swinehart Company has notified the trade at large that any cushion tire having recesses in its sides and presenting an unbroken tread surface is an infringement on the Cadwell patent and that all buying, dealing in, or using the same will be held to account by the owners of the patent.

PARTS MAKERS ELECT OFFICERS.

AT the recent annual meeting of the Standard Roller Bearing Company, of Philadelphia, the following directors were elected for the ensuing year: Lenox Smith, Isaac H. Clothier, W. B. Osgood Field, Henry De Forest Baldwin, Edwin Packard, Herbert Dupuy, Edward B. Smith, John C. Winston, George H. B. Marton, James Boyd, and R. S. Woodward, Jr. These directors elected the following officers for the ensuing year: President, Lenox Smith; vice-president, W. B. Osgood Field; vice-president and general manager, R. S. Woodward, Jr.; secretary and treasurer, W. M. Baldwin.

ELWELL-PARKER ABSORBED BY ANDERSON.

THE Elwell-Parker Electric Company, making motors in Cleveland, Ohio, has been absorbed by the Anderson Carriage Company of Detroit. The latter concern now specializes the production of pleasure cars, but, it is understood, will soon undertake the manufacture of electric wagons, trucks and cabs. The capital stock of the Anderson Company has been increased from $500,000 to $1,000,000.

CLASSIFIED ADVERTISING.

Advertisements under this heading are charged for at the rate of three cents a word, including address; minimum charge $1 for each insertion; no illustrations; cash must accompany order.

BEST OFFER ACCEPTED FOR HART-KRAFT Commercial Cars, 1909 Model, 1,000 lbs. capacity, full panel bodies. We have seven of these cars, four brand new, others slightly used. Cost $1,250 apiece. Will be sold singly or together. Make an offer as they MUST BE SOLD. Indianapolis Motor Car Co., 419-423 East Market St., Indianapolis, Ind.

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Buy What the Experts Buy

THE ELECTRIC STORAGE BATTERY CO. 1888 1909

NEW YORK BOSTON CHICAGO ST. LOUIS PHILADELPHIA, PA. CLEVELAND ATLANTA SAN FRANCISCO TORONTO

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Motor Trucks

It isn't a question of Yes or No, but **Which.**

The motor truck has come to stay. It is a recognized factor in the economic conduct of modern business.

The Mitchell Truck comes to you with all the prestige of the name of Mitchell.

The entire output of Mitchell pleasure cars for 1909 was taken **before the year began.** Our immense plant is now running overtime to meet deliveries.

The Mitchell Motor Truck has every feature of excellence, of material, skillful designing and expert workmanship that has made the Mitchell line famous.

As that word "famous" is a much abused term, let us explain by saying that more Mitchells are sold to-day than any other high-grade American car.

Write and ask us about the Mitchell Truck. Ask us about the 1169-mile trip with a 3400-pound load over the most abominable roads, at an expense of only $39.40 for gasoline, oil and grease.

Let us tell you about the improvements we have made in this truck since then.

A 4-cylinder truck—20 horse power—ton-and-a-half capacity—price $2,000.

For full information write Mitchell Motor Car Co., 569 Mitchell St., Racine, Wis., Standard Manufacturers A. M. C. M. A.

European Branch: No. 20 Rue de Tilsitt, Paris, France.

Mitchell

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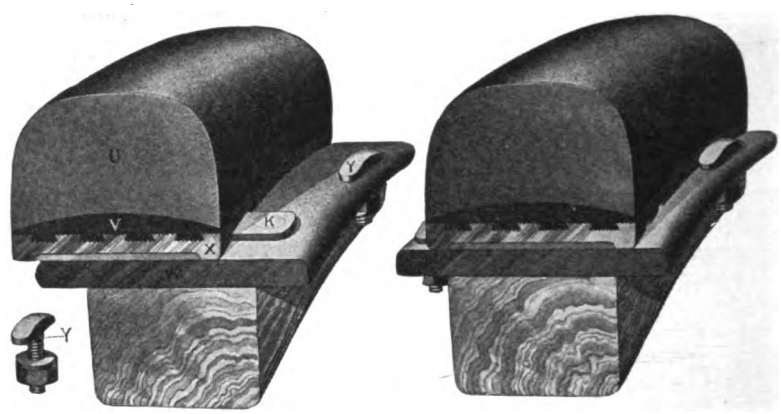
THE GOODRICH "WIRELESS" MOTOR TRUCK TIRE

The construction of the Goodrich Wireless Tire marks as great and important an advance over all other types of motor truck tires as does the wireless telegraph over all other methods of signaling at sea. It sets entirely new standards of mileage obtainable, cost per mile, and freedom from repairs.



Construction:—This tire consists of three integral factors: (X) a special steel base having dove-tailed grooves on the top surface; (V) a hard rubber sub-base which is inseparably united with the steel base; and (U) soft rubber tread or tire proper, which is inseparably vulcanized upon the hard rubber sub-base. The tire is held in place upon a special steel felloe band (W) by means of lugs (Y) on either side of the steel base, and a key (K) on the felloe band which fits into a key-seat on the steel base of the tire, preventing circumferential movement. Thus the fastening point of the Wireless tire is steel to steel, and absolutely secure.

ADVANTAGES:

The Goodrich "Wireless" tire affords the following advantages over all other types of motor truck tires:

(1) **Increased Mileage,** because it affords a maximum external abrasion without affecting its fastening to the wheel.

(2) **Decreased cost per mile,** because it will give more mileage in proportion to its cost, than any other rubber truck tire.

(3) **Freedom from repairs,** because the component factors form an inseparable unit and thus eliminate the usual hinging action of the rubber over internal metal fastenings.

(4) **Simpler method of applying.** The principle of application of this tire is that of a drive fit between two metal surfaces, which are of such a nature that they oxidize or freeze together to a marked degree immediately after application. No complicated tire setting machine is therefore necessary.

(5) **Better service from the dual type,** because of decreased width of tread over all, affording maximum contact with road service and more perfect distribution of the weight upon the spokes.

(6) **Adaptability to standard wheel sizes,** because the Goodrich "Wireless" tire may be applied to any wheel at present made for solid rubber motor truck tires.

(7) **The Wireless Guarantee.** We guarantee this tire to be free from defects in material and workmanship; and we also place Special Guarantees for certain periods of time on both rapid and slow moving truck tires.

Detailed information regarding sizes, prices, discounts, guarantees, etc., will be promply furnished upon application to any of our Branches, or to the Motor Truck Fire Department of our factory.

THE B. F. GOODRICH COMPANY, AKRON, OHIO

BRANCHES IN ALL LARGE CITIES

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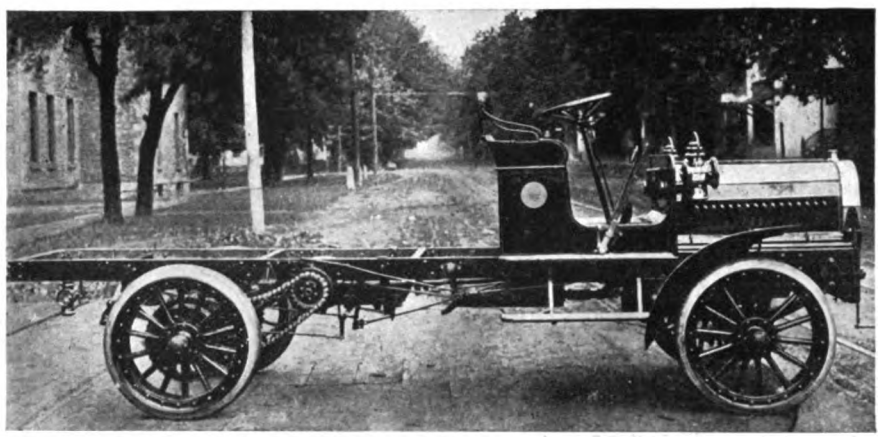
"AMERICAN" WORTHY THE NAME

Always Good, Now Better than Ever

3 STANDARD CHASSIS 3

MODELS "O" 5-Ton "L" 3-Ton "M" 2-Ton

Write for Catalog 209 and Specifications of Capacity You Require.



1910 Model M Chassis—1½ to 2 Tons Capacity.

AMERICAN MOTOR TRUCK CO., Lockport, N. Y.

Manufacturers COMMERCIAL AUTOMOBILES for All Purposes

Quick Delivery

Pressed Steel Automobile Frames

Extensive press equipment recently installed enables us to take on more pressed steel frame business for quick delivery. Send us blue prints for quotations.

A. O. SMITH COMPANY

251 Clinton Street, Milwaukee

FRONTENAC

Gasoline Commercial Trucks, Simple in operation with low cost for repairs and maintenance.

ABENDROTH & ROOT MFG. CO.

Newburgh, New York

Veeder Odometers

Made for all makes and types of motor truck, delivery wagons and commercial vehicles.

STANDARD DISTANCE RECORDERS

THE VEEDER MFG. CO.

47 Sargeant St. HARTFORD, CONN.

Price $10.00 Complete

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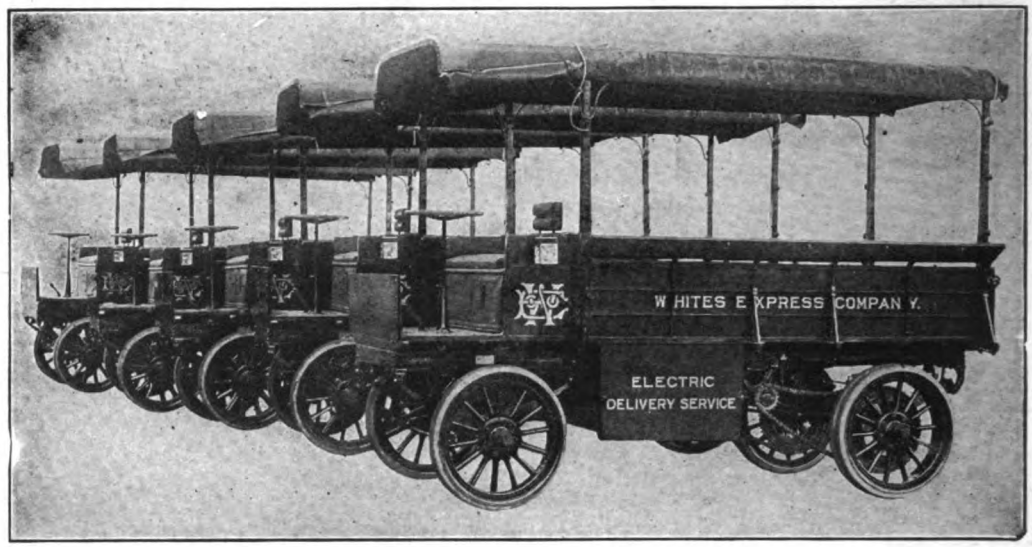
The whole equipment of White's express comprises **FOUR TWO-TON** and **SIX THREE AND-A-HALF TON** General Vehicle Company Trucks. ¶ **EIGHT WERE ORDERED** from us after **TWO** had **PROVED** their **VALUE** by **EARNING CAPACITY** under **TEST.**

The above is a good **OBJECT LESSON** to skeptical **CENTRAL STATION MANAGERS** who have not seen the advantages of additional income from electric vehicles.

Write us and we will tell you what can be accomplished by co-operation, also the increased **INCOME SUCH A LOAD MEANS** in unit earnings and how **MUCH LOSS IT MIGHT HAVE MEANT** if gasoline machines had been used.



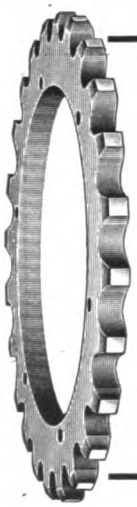
GENERAL VEHICLE COMPANY

Principal Office and Factory
LONG ISLAND CITY, N. Y.

New York Office
505 FIFTH AVENUE

Boston Office
84 STATE STREET

Chicago Office
417 THE ROOKERY



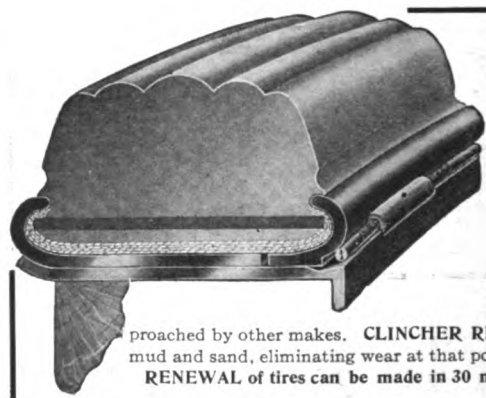
SPROCKETS
FOR
MOTOR TRUCKS

in Stock and to Order.

CULLMAN DIFFERENTIALS

Send for Complete Catalog.

CULLMAN WHEEL COMPANY
1017 Greenwood Terrace CHICAGO



SWINEHART TIRES
for Commercial Truck in Connection with
QUICK DETACHABLE RIMS

insure economy and convenience unapproached by other makes. **CLINCHER RIMS** protect base from mud and sand, eliminating wear at that point.

RENEWAL of tires can be made in 30 minutes. NO DELAY.

Swinehart Clincher Tire & Rubber Company, Akron, Ohio

Our Lines

of pleasure vehicle motors differ from those for business wagons, each line being designed with special reference to the work for which it is intended.

Send for Circular 1059, it gives particulars

Westinghouse Electric & Mfg. Co.
PITTSBURG, PA.
Sales Agent, American Distributing Co.
American Trust Building CLEVELAND, OHIO

GIBNEY WIRELESS MOTOR TIRES

wear longer because they stay on your wheels longer than any other solid tire made.

The secret of their longevity is their ABSOLUTE SECURITY. They positively can't come off.

Let us have your specifications for your next truck tires. We are sure that we can satisfy you.

Our catalog, containing prices and guarantee, will be mailed upon application.

JAS. L. GIBNEY & BRO., Philadelphia, U.S.A.

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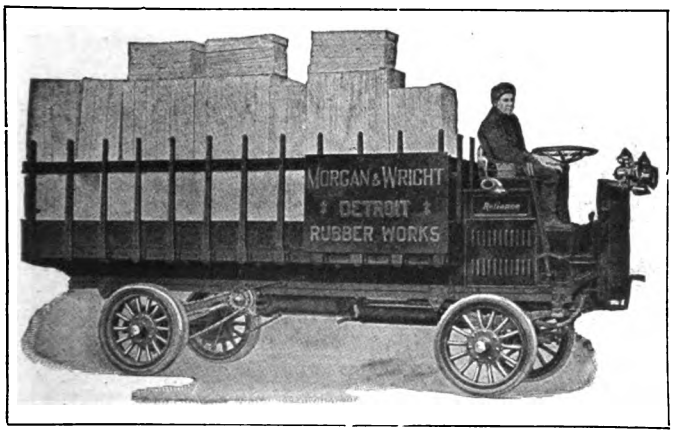

Reliance Motor Truck Co.

Owosso, Mich.

Chicago Branch

390-392 Wabash Avenue

CHICAGO SO. OMAHA ST. JOSEPH

Omaha Packing Company.

Pork and Beef Packers.

Address all Correspondence to the Company

Chicago, Dec. 21, 1908.

The Hoopeston Gas & Electric Co.,
Hoopeston, Ill.,
Gentlemen:—

Replying to your inquiry of the 17th in regard to Reliance Motor Trucks, beg to say that we have one of these machines in use about seventeen months, and we put the second one in use about three weeks ago. We find it saves us considerable in our teaming expense over teams.

We find that their new models are far superior in regard to strength over the old machines, although our old machine has been very satisfactory.

For your information will state that our affiliated Company have purchased six or eight of these machines in the last three months.

Yours truly,
OMAHA PACKING COMPANY,
GWC-B G. W. Constantine, Supt.

Diamond

Wire Mesh Base Tires for Motor Trucks and Commercial Motor Vehicles

Made in both Single and Twin Types. Can't come off, but can be **taken off** and applied without the aid of machinery.

Stock "Just Right" for Motor Truck Service.
Resilient—Tough—Wear-resisting

THE DIAMOND RUBBER CO.

AKRON, OHIO.

BRANCHES IN ALL PRINCIPAL CITIES.
NEW COMPLETE CATALOG ON REQUEST.

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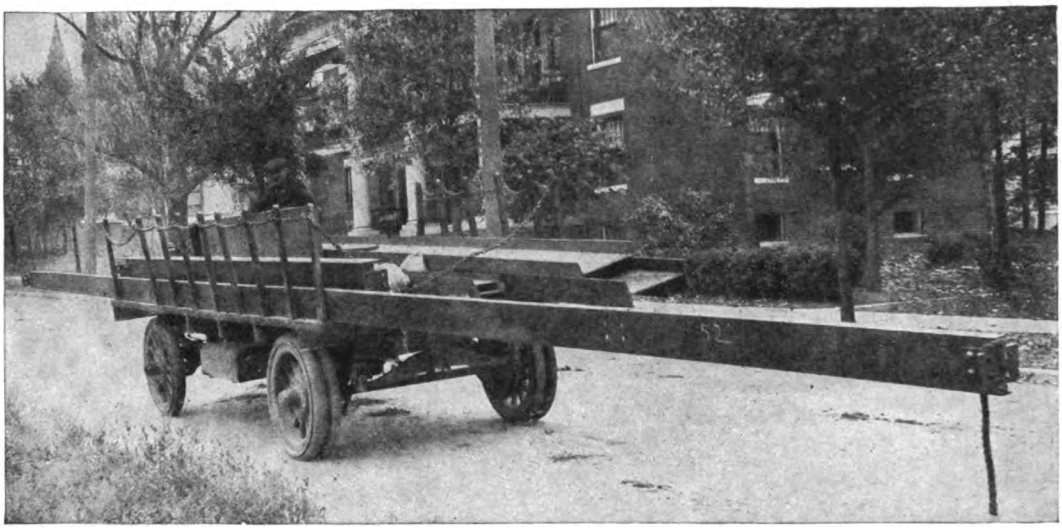
HEAVY HAULAGE AT LOW COST.
ONE MACHINE DOES THE WORK OF FOUR TEAMS.



Our agents at Kansas City recently received the following communication from a local establishment which is using one of our 3-ton trucks :

Kansas City Auto Truck Co., Kansas City, Mo.

Gentlemen—When we purchased a three ton Frayer-Miller Truck from you about two months ago, we told you we would report, after using the machine two or three months, and advise you of the amount of work we are getting out of it, and also of the cost of keeping same in first-class repair.

We beg to advise that we have now given the truck a very thorough trial and find that it even surpasses what we first considered exaggerated estimates of the work it could do. We are making four trips a day between our plant and Kansas City, Mo., a distance of six and one-third miles. Our loads to the city average from three and a half to four tons, and our loads on the return from the city, of material which we pick up at different business houses, one and a half to three tons. We find that we are able to haul material from 50 ft. to 60 ft. long, instead of 35 ft., such as the truck was designed for.

Our expense for repairs has been practically nothing. The truck is doing the work previously done by four teams, and we assure you that as soon as we are in the market for another machine we certainly will use the Frayer-Miller.

November 5, 1909. Yours very truly, KANSAS CITY STRUCTURAL STEEL CO.,
NEIL G. LILLEY, Secretary.

THE OSCAR LEAR AUTOMOBILE CO., - SPRINGFIELD, OHIO

Hammered Forgings, Machined Parts, Pressed Steel

And complete units even in small quantities to your designs

Driggs Seabury Ordnance Corp., Sharon, Penn.

It May Be a Coincidence—

but certain it is that the truck owners who are the most enthusiastic over motor truck haulage—the truck owners who can show the greatest saving over horse truck expense — are the ones who are using

Morgan & Wright Side Wire Tires

The reason is evident. Morgan & Wright tires are made by a process developed by our twenty-eight years' experience in the making of rubber goods, which prevents the chipping and cracking that so commonly destroy tires long before they are worn down enough to be useless.

Morgan & Wright tires will give a mileage which will satisfy even the most exacting.

Morgan & Wright, Detroit

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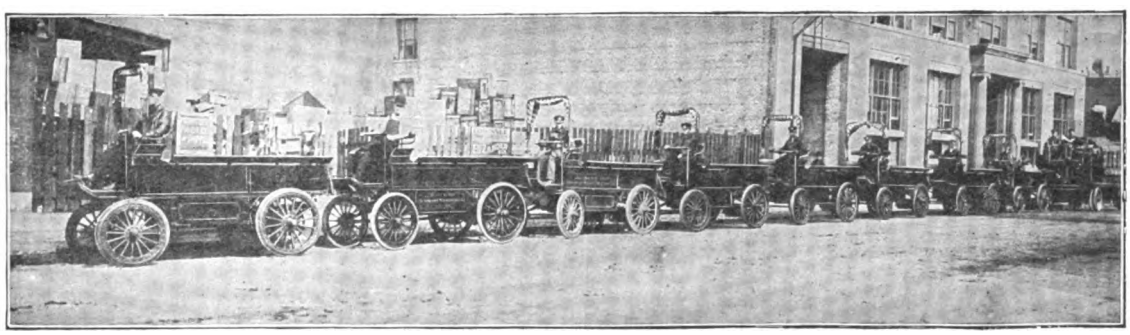
If You Manufacture, Own or Intend Purchasing

COMMERCIAL ELECTRIC VEHICLES

Read Below:



A ROW OF COMMONWEALTH EDISON COMPANY'S POWER WAGONS READY FOR THE DAY'S WORK

We will be glad to co-operate with manufacturers and owners of Commercial Electric Vehicles in improving and perfecting this type of truck which is daily growing in popular favor.

A number of Chicago's largest commercial houses are utilizing electric trucks with notable success; more would doubtless use them if they were familiar with the superior facilities provided for their use.

We Maintain Charging Plugs
at nearly all of our stations and sub-stations for the accommodation of those operating electric vehicles of any kind.

We would be glad to advise any one in Chicago contemplating the purchase of an electric vehicle as to where they may make arrangements for charging and up-keep.

We Install Charging Outfts for Private Use anywhere in Chicago and can refer to a number of installations. We solicit correspondence from manufacturers of traffic vehicles; also from those intending to purchase.

Commonwealth Edison Company
139 Adams Street, Chicago

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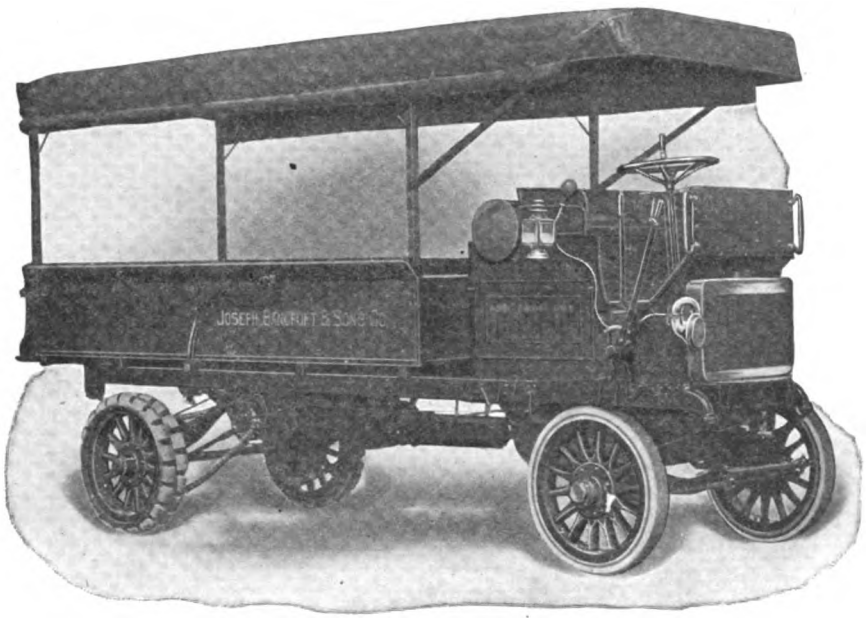


FOUR CYLINDER

Knox

WATER COOLED

4-Cylinder, 40 H. P., 3-ton capacity.

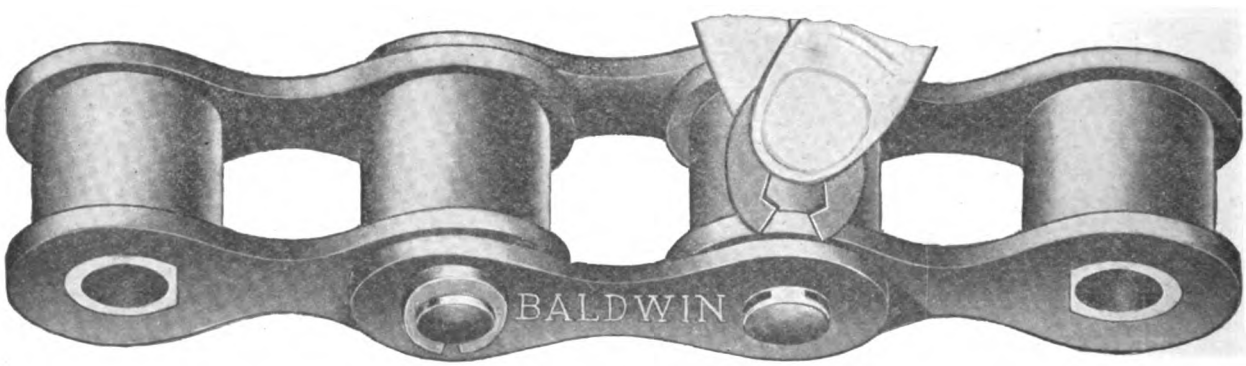
10 Standard Chasses. Any Capacity up to Seven Tons.

Knox Automobile Company

Licensed Under Selden Patent.

Member A. L. A. M.

SPRINGFIELD, MASS.



Baldwin Improved Detachable Chain is especially suitable for trucks. The design is the best for a detachable chain ever made. Firm and durable as a riveted chain. The split collars on the rivets are not springs, but a substantial piece of metal that can be opened and closed without fracture.

We solicit an opportunity to quote on sprockets for special purposes and in quantities.

BALDWIN SPROCKETS AND CHAINS

BALDWIN CHAIN & MFG. CO.

WORCESTER, MASS:

AGENTS { H.V. GREENWOOD, 166 Lake St. Chicago, Ill.
C. J. IVEN, Rochester, N. Y.
M. A. BRYTE, 718 Mission St., San Francisco, Cal.

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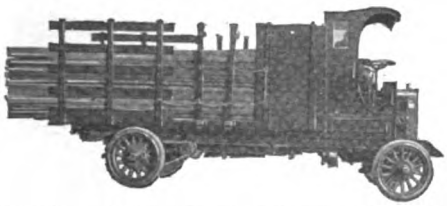
Rapid 5-Ton Truck Loaded with 6¾ Tons Lumber, approximately 4,000 feet.



Built for trucking companies, storage and moving companies, ice, coal, lumber, salt and mining companies, flour mills, steel works or for any business requiring a heavy-duty power wagon.

The Rapid **Heavy-Duty Power Wagon**

¶ Here is a masterpiece of mechanical construction—a heavy-duty truck which is in every sense **"built for business."** It is designed with liberal allowances for overload—to stand hard-knocks—to do the roughest kind of work at the least expense. **RAPID Heavy-Duty Power Wagons** are made by the oldest exclusive commercial car makers in the country—backed by a guarantee that protects the user, and are recommended to all customers desiring the best and most modern heavy duty power wagons now produced.

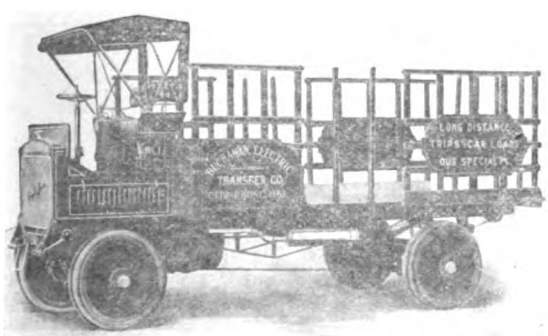
¶ Send for literature about Rapid Heavy-Duty Power Wagons which are made in 3, 4, 5 and 6-ton sizes, with bodies for any kind of service.

RAPID MOTOR VEHICLE COMPANY, 110 Rapid St., PONTIAC, MICH., U. S. A.

TWO SECOND-HAND AUTOMOBILE TRUCKS FOR SALE BIG BARGAINS

WE have for sale two motor trucks which have been thoroughly overhauled and repainted by the manufacturers, and are guaranteed in A-1 condition. One of them has been in use less than seven months; it has a carrying capacity of 1½ tons; a speed of about 15 miles an hour, and has a body platform 58 inches wide and 111 inches long. Equipped with waterproof canvas top with side and front curtains, oil lamps and tools. The other one carries a three ton load and has a speed of about 12 miles an hour, a body platform 60 inches wide and 144 inches long. These cars were turned in as part payment by satisfied owners who have purchased machines of greater carrying capacity. We have put them in our shop, had all worn parts of engine, transmission, etc., replaced with new ones and the entire power plant and running gear put in excellent shape. Satisfactory demonstrations will be given to prospective purchasers. A full examination of the machines will prove them to be exceptional bargains at the prices asked.

KNOX AUTOMOBILE CO., - 1966 Broadway, New York City



A New Couple Gear The Gas-Electric Kind

Same 4-wheel drive and steer, but power is furnished by gas engine and generator. Unlimited mileage, almost unlimited power. Write for full particulars.

Couple-Gear Freight-Wheel Co.
550 Buchanan Street, GRAND RAPIDS, MICH.

New York Agency - - - 30th Floor Singer Building
Chicago Agency - - - 737 Monadnock Building

Subscription Agents Wanted

Liberal Terms

APPLY TO

THE POWER WAGON
CHICAGO

ALWAYS GOING

Don't Buy A Truck Until You Have Investigated Our Line

We make two sizes:
2000 to 3000 pounds,
6000 to 8000 pounds.

THE Sternberg Mfg. Co.
Milwaukee, Wis.

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Packard TRUCK

Normal load capacity, 3 tons.

Price, in standard finish and equipment, $3,850, f. o. b. factory.

Special bodies made to order.

1910

BUILT ENTIRELY IN THE PACKARD SHOPS

Packard Motor Car Company
Detroit, Michigan

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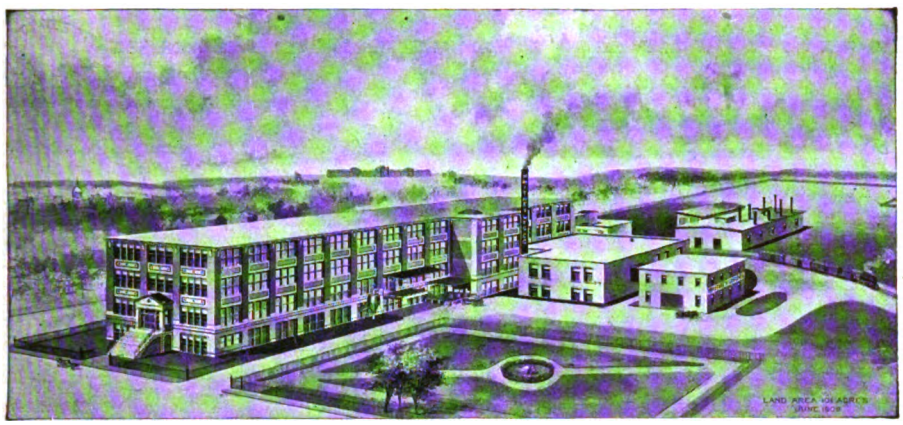
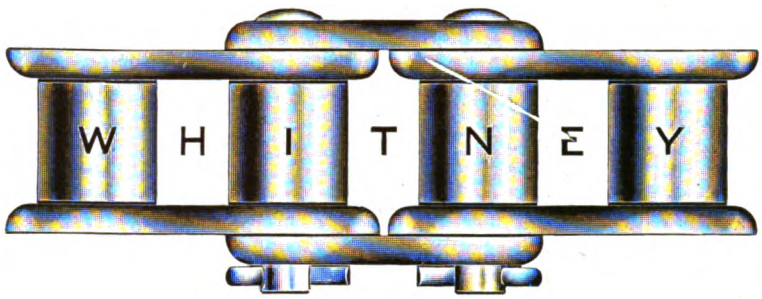


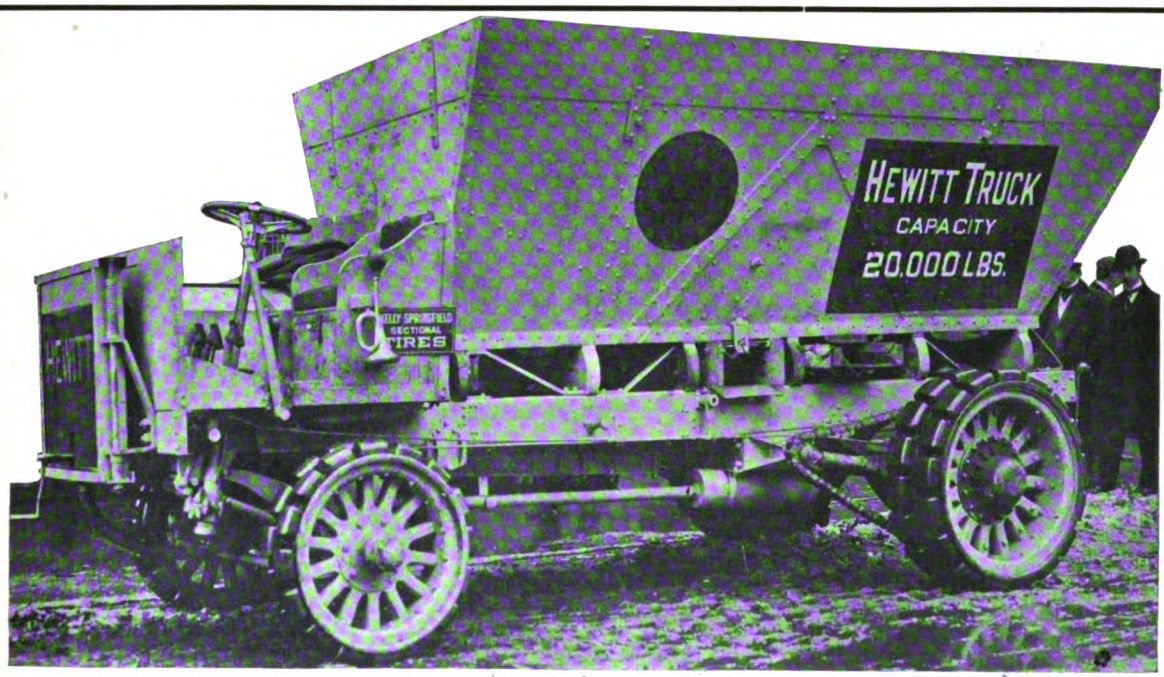
"WHITNEY" CHAINS

are used by the Leading American Makers of Commercial Cars. A list of cars driven by "WHITNEY" CHAINS will be furnished on application.

The "Whitney" Patent Cotter Detachable Chain has made for itself a record which no other Detachable type has approached. It is favorably known from the Atlantic to the Pacific by jobbers, dealers and users. In an emergency a nail, wire, or ordinary steel cotter can be used as a substitute for our special phosphor bronze cotter pins, but it would be difficult to find a substitute for any detachable locking device of special design.



The Whitney Mfg. Co., Hartford Conn.



SOLVED!

Is the way the motor car experts express themselves on the subject of tires for commercial motor vehicles after seeing and using the

Kelly-Springfield Sectional Tire

With a grip on the road that means progress and security from the fault of solid tires--that of crowding the rubber ahead under load, which means disintegration--the motor wagon and truck owner will find in the Kelly-Springfield Sectional Tires the best tire for all heavy cars. Each section is dependent upon itself. If interested, write

CONSOLIDATED RUBBER TIRE COMPANY

NEW YORK, N. Y., and AKRON, OHIO

BRANCHES: Boston, Chicago, Philadelphia, St. Louis, Detroit, Cincinnati, San Francisco.

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A PAYING INVESTMENT

¶ Do you believe that, in the majority of cases, city merchandise can be more economically transported by power wagons than by horses?

¶ Of course you do.

¶ But do you know the extent of the economy to be gained by the substitution of motor trucks and wagons for horse drawn vehicles?

¶ Few people do.

¶ "The Power Wagon" assists every branch of business in which local transportation plays an important part, by showing how and to what extent motor vehicles may be used to advantage.

¶ Possibly such work interests you.

If it does you should subscribe for the paper.

Price, $2.00 a Year

THE POWER WAGON PUBLISHING CO.

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